



# Journal

Third Quarter 1981



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IN THE TOTAL FORCE (p. 21)

*Bryen*

## **2** A new look at United States defense industrial preparedness

*Lawrence J. Korb*

Given the course of world events over the past few years, it has become apparent to many defense planners that the present conceptual approach to defining the requirement for U.S. defense industrial preparedness is ripe for rethinking. In this article, the author details the practical considerations that demand such a rethinking, proposes a new concept of defense industrial preparedness planning for consideration, and calls for a recommitment of people and resources to tackle this serious national security problem.

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*Dorsey J. Talley*

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*Major General W. Stanford Smith, AUS (Ret.)*

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To insure that Air Reserve forces are effectively employed, Air Force planners need accurate information concerning their availability and capability. In this article, the authors review the results of a survey of active-force officers' perceptions of the Air Reserves and consider how such perceptions might influence use of the Reserve forces.

The *Defense Management Journal* is a quarterly publication of the Office of the Assistant Secretary of Defense (Manpower, Reserve Affairs and Logistics). As a forum for the interchange of ideas, the *DMJ* publishes articles on current defense policies and on methods for improving defense management. Unless otherwise stated, the views herein are those of the authors and

are not necessarily those of the Department of Defense or any of its elements.

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*Colonel Wilfred L. Ebel, USAR*

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*Richard LaBrie  
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Reducing unprogrammed losses is essential to increasing the strength and readiness of the Selected Reserves. In this article, the authors report on research undertaken to identify factors which influence attrition and retention in the Army Reserve and Army National Guard. Data indicate that external factors, especially the attitudes of spouses, are major determinants of retention.

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**46** Challenge of the eighties: equipping the Guard and Reserve

*Captain P. E. Smith, USN*

Adequately equipping the Reserve forces is a longstanding problem with potentially serious national security ramifications. In this article, the author presents a historical perspective on this issue and stresses the need to formulate coherent and rational programs for equipping the Reserves to meet the needs of the 1980s.

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*David W. Grissmer  
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Four successive years of declining Army Selected Reserve strength in the mid-1970s caused a deterioration in readiness that endangered the all-volunteer concept. The research summarized in this article suggests that the effects of direct pay incentives on Reserve reenlistments are smaller than previously estimated and that nonmonetary factors strongly influence the reenlistment decision.

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that industrial base revitalization is an agreed specification of the basic requirement or mobilization scenario against which our base improvement plans can be designed. Several of the many plausible mobilization scenarios imply very different decisions on specific issues—for example, the production capacity (and thus indirectly the expansion potential) to be created for a specific new weapon system, or whether a certain opportunity to improve the responsiveness of a specific production process justifies the cost.

This article presents one senior Defense official's concept of how the requirement for industrial preparedness planning should be specified. It is not the official DoD position on this crucial issue. Other senior Defense officials have other ideas. Future issues of *DMJ* can be expected to present one or more of those counter views in the interest of furthering the dialogue on this important issue.

Meanwhile, this dialogue should not be interpreted as a diminution of the Department's determination to press the various technical solutions now being implemented for generic production-base deficiencies.

These measures, which include such elements as lead-time reduction, productivity improvement, incentives for capital investment, and materials availability, offer fundamental improvement to the health of the base; their implementation is required regardless of the eventual resolution of the larger planning issues treated in the article.

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**S**ustainability and industrial preparedness are obviously closely related. In fact, industrial preparedness is just one key element of sustainability. This broad issue of sustainability—that is, the conflict duration for which the Department of Defense should design its combat and support forces and size its support resources—has been a contentious issue within DoD for nearly a decade. Although the Reagan Administration has not yet had time to seek a consensus within the government on the specific level of combat sustainability that should be sought, it has made it clear that our combat forces must be provided more staying power than they now possess or have programmed. Nevertheless, there remains wide disagreement about the relevance of U.S. defense industrial preparedness in the types of combat scenarios that it appears DoD must prepare for.

It is abundantly clear that the world has changed enough in the last decade to precipitate a rethinking of the utility of, as well as the approach to, defense industrial preparedness. That rethinking must lead away from the idea of anticipating the right *conflict* scenario and attempting to design our industrial preparedness program to respond to that specific scenario; instead, it should lead towards planning and preparing for galvanizing the base for dealing with threats and provocations short of actual conflict. Fred C. Ikle, the Under Secretary of Defense for Policy, has referred to this capability

as essential “defense expansion capability.” However, even if we can shift the approach, there are reasons why any industrial preparedness program will be difficult.

First, modern technology has fundamentally changed the scope of the industrial preparedness problem and the avenues that offer some promise for solutions. Vastly increased weapon system sophistication and complexity have had a major impact on the production-base capacity and responsiveness that we can afford to acquire. To illustrate, let's say that one turns the clock back and defines as a baseline the set of production facilities, capital equipment, subcontractor capacities, network of subordinate vendors, etc., that could produce five F-15s per month in peacetime most efficiently. By definition, we would have a base with very little slack capacity and limited capability to accelerate. If we then, alternatively, specified that we wanted the capability to accelerate production from 5 to 25 per month within 12 months of the decision, we could demonstrate that the cheapest solution would entail a substantial incremental cost above the baseline.

Second, even if we were willing to pay the financial cost of a highly responsive production base—with substantial peacetime slack capacity—we would still confront a planning, management, and information-handling task of staggering proportions. Production of a single major system such as

another. Moreover, different divisions of the same company can be prime contractors and subcontractors simultaneously. There may be as many as five tiers of subcontractors. The first-tier subcontractor would typically produce major assemblies (for example, avionics or fire control); the second tier, "black boxes" or subassemblies such as a landing gear assembly; and so on through the lowest tier, which would provide raw materials. Of course, problems encountered at any level of the hierarchy reverberate throughout the entire system.

For example, the F-15 program involves about 300 major subcontractors on the first tier, with the total number of firms involved at all levels in the thousands. While the government's visibility and control over the prime contractors and, to a lesser extent, the first-level subcontractors is significant, keeping track of all of the lower-tier firms involved in producing several thousand items presents a formidable information-handling task. It is probably not an exaggeration to say that the planning task, if DoD chose to "manage" that process, would be at least as complex as the effort to put a man on the moon. Indeed, in many very important ways, the industrial mobilization planning problem in today's high-technology world is probably much more complicated than that space program.

Although we presently have some surge capability in our aircraft production base, it exists only because we have been producing several types of aircraft at rates well below those for which the plant capacities were sized, largely because of past budget constraints. Thus, that slack capacity and expansion potential is largely accident and hardly the product of any rational, coherent plan.

Third, at the same time that technology is reducing the production-base acceleration capability that it is feasible to acquire and maintain, similar technology advances are vastly compressing the time within which conflict can break out, expand, and possibly proceed to a decisive outcome.

Fourth, modern weapon systems and their supporting equipment are so expensive that DoD has followed a policy of not even attempting to buy war reserves—that is, combat attrition replace-

as attrition fillers for later use in a conflict.

Similarly, the price of a week's worth of combat attrition replacement equipment for an Army division is becoming so enormous that a similar practice may develop in this area. The cost of land-force combat equipment—for example, \$2.7-million tanks—seems to be moving us inexorably toward the practice of providing little or no war reserve equipment for the ground forces either. Although I think this practice is unwise, it is understandable. Within past limited budgets, DoD could do little more than create and equip the combat force structure. Because of the critical importance of the first days of a war in Europe, DoD moved to increase its D-Day, in-theater, combat-force structure through a program to pre-position equipment in Europe. This Pre-positioning Of Materiel Configured in Unit Sets, known as the POMCUS program, competes with war reserve equipment needs for available equipment and new procurement funding. In recent years, filling POMCUS has been given a higher priority than has the building of war reserve stockpiles. As a result, we have major voids in our required war reserves of combat equipment. But within an expanding budget, there may be room to do both.

Paradoxically, while funding for war reserve equipment all but vanished, greater munitions sophistication, effectiveness, and unit costs dramatically increased the expense of sustainability. For example, if one uses the Army's latest analytically derived consumption estimates for a hypothetical war in Europe, consumption of a representative mix of modern munitions by a six-tube artillery battery of 155mm howitzers is estimated to cost about \$4 million per week in the early stages of conflict and about \$1.2 million per week in the sixth month. In comparison, the same battery firing today's conventional high-explosive round at a rate consistent with intense periods of World War II and the Korean conflict would consume only about \$500,000 per week. If one applied the modern munition consumption factors and costs to the U.S. force levels expected to be deployed in Europe, the cost of supporting our

\$1.7 billion in the sixth month. Equipment losses on the modern battlefield are also projected to be much higher than in previous wars. The projected loss rate of the M60 tank, for example, is more than eight times that experienced in World War II.

Fifth, international politics and strategy reinforce the pressures that have made significant investments in industrial mobilization enhancement less appealing. Our North Atlantic Treaty Organization allies' clear and continuing disinterest in buying substantial conventional sustainability—presumably for fear, in their view, of undermining the West's strategic nuclear deterrent—has acted as a very real and effective brake on any enthusiasm that might otherwise have been generated within U.S. defense circles for a major effort to increase our industrial mobilization capability for war. By 1987, our stockpile of ammunition in Europe will be twice as large (expressed in days of combat consumption) as the goal to which the Allies have agreed, and many of the Allies have stated that they will not meet even this modest commitment. This large gap between U.S. sustainability and that of our Allies has made a further increase in sustainability difficult to sell in the Pentagon and to some parts of Congress.

Sixth, frequent shifts in guidance from the Office of the Secretary of Defense on industrial-base retention, modernization, new capacity sizing, and other aspects of industrial preparedness have made it impossible to develop a stable policy in this area. Several previous defense secretaries made those changes in an attempt to keep the guidance for industrial preparedness logically consistent with the strategic thinking that underlay the design of defense combat forces and the support they would need in the conflict scenarios they believed we must be prepared for. For example, after President Nixon's visit to the People's Republic of China and subsequent improved relations between the two nations, the then-secretary of defense's planning and programming guidance to the military services was changed to assume that any attack by North Korea on South Korea would not actively involve the Chinese. In turn, the intelligence community estimated that, given the North Korean-South Korean

ground and air forces had previously been hypothesized and used as the basis for sizing the U.S. industrial base as part of a "D-to-P"<sup>1</sup> computation, DoD was driven by an assessment of changing world conditions to assume that: the U.S. and South Korea were unlikely to face the Chinese in a Northeast Asia conflict; substantial additional U.S. ground forces were unlikely to be required for a defense of South Korea; and any defense of South Korea was unlikely to be protracted. The result was that the revised Northeast Asia scenario no longer offered a plausible basis for a "D-to-P" requirements computation or the basis for sizing the production base.

The combination of the above six factors means that:

- While the high cost of sustainability makes us more and more penurious about the conflict duration for which we are willing to buy war reserves, technological complexity is stretching out production-base response times.
- As a result, if our planning must assume that a major war breaks out with little warning, we see that the time gap continues to widen between the likely exhaustion of our war reserves and the point when we could expect expanded output from our production base.
- The attitude of our NATO allies and the lack of stable policy guidance complicates efforts to deal with this situation logically; therefore, investment in industrial mobilization enhancement to support a *major conflict scenario* has come to be viewed as too expensive and difficult.

Although it will continue to be very difficult to defend in program and budget reviews the sizeable resources that would be required to create a broad and responsive defense industrial base for a conflict scenario, we do have serious deficiencies in the industrial base that must be addressed. Moreover, I

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<sup>1</sup> "D-to-P" refers to a planning concept under which one computes the quantity of war reserves (e.g., of a munition or equipment item) that must be in inventory on D-Day in order to fill the gap between wartime consumption rate and production rate, out to the point (P-Day) when the production rate could be expanded to match or exceed the consumption rate. This concept often involves some trade-off analysis that seeks the least-cost mix of war reserves and production-base respon-

stitutes an adequate U.S. peacetime defense posture. By this, I mean a set of circumstances that leads the President, the defense leadership, the Congress, and the American people to conclude that then-current defense force levels must be increased substantially and immediately, and leaves them willing to pay the bill that entails. We have just seen, in the Reagan Administration's sizeable increases in the Carter Administration's FY 1981 and FY 1982 defense budget requests, evidence that perceptions of need can change substantially and quickly. Although this change was precipitated by a change in Administrations and a deterioration in world conditions, even more substantial increases in defense spending might be occasioned by a dramatic worsening of world tensions short of war—for example, a Soviet invasion of Poland.

There is some historical evidence to support the contention that such a shift in thinking short of war is conceivable. For example, in response to the war in Europe in 1939-41, but prior to the attack on Pearl Harbor, the U.S. defense budget grew tenfold within about two years. And the threefold expansion in the U.S. defense budget after the outbreak of the Korean War was primarily designed to improve our global military strength; only secondarily was it meant to strengthen our forces in Korea. Another example is President Kennedy's directed build-up in response to the 1961 Berlin crisis.

It seems clear that some major crisis might again occur that might spur the U.S. to expand defense production dramatically. In such a crisis it might well be vital that the expansion be accomplished quickly—within two to three years rather than after a four- to six-year delay. Herman Kahn has speculated for some years about the plausibility of a mobilization competition between the United States and the Soviet Union that would run its course to a decisive conclusion without a shot being fired.<sup>2</sup>

Unfortunately, if a rapid change in the world climate suddenly made 12-15 percent of the U.S. gross national product—rather than today's 5-6

<sup>2</sup> See, for example, Hudson Institute Research Report 2237RR, "Technological Requirements of Mobilization War."

not be able to produce all of it quickly even if we did. Thus, we should shift our focus on industrial preparedness planning to thinking out in advance what kinds of emergency peacetime force expansions we might want under various circumstances. We should then determine what we should do about today's industrial base and the factors that influence it so that we could execute such a force expansion quickly, efficiently, and coherently. This essential ingredient of *specific objectives* for industrial base responsiveness has been missing from most of the arguments for an improved defense industrial capability.

This approach requires that we reorient industrial preparedness planning to address a very different problem: what kind of planning do we do, what kinds of investments do we make, and what total cost over the next T years if, at the end of those T years, we want to be able to expand components A, B, and C of our combat forces to fractions G, H, and I, respectively, within Z years. For example, if we want to be capable five years from now of expanding from 16 to 24 fully equipped, active Army divisions within two years, what actions must be taken now? What facilities must be built? What critical materials must be stockpiled? How do these answers change if T is three or seven years rather than five years? How small does T have to get before we would have to say we cannot get that capability at time T within any remotely feasible resource levels? Although this new statement of the problem is incredibly complicated in itself, in some ways it is simpler than the approach of planning industrial preparedness against a specific conflict scenario. At least with this new approach, one does not have to guess at combat attrition and consumption rates.

Let's illustrate this idea a little less abstractly. Every three years or so a planning group comprising representatives from the Secretary of Defense staff and the Joint Chiefs of Staff could look, say, five years ahead and ask: "If, in response to some unforeseen emergency short of war, the FY 1981 defense program were to be increased by, for example, 50 percent above the level in the currently approved program and succeeding budgets, could

strategic nuclear capabilities and one that would focus all the growth on general-purpose forces. For each major force-expansion strategy, this planning group, through a process of iterative, aggregate analysis and argumentation, would establish the relative magnitudes of the force expansion desired in the various components of our defense capability: heavy ground forces, light ground forces, strategic airlift, fast sealift, sophisticated (high-threat) air-superiority fighters, close-air-support attack aircraft, etc. These objectives would be described in terms of the percent force expansion by force or weapon type desired per year, for example, for the three years beginning in FY 1987.

In turn, the appropriate offices would determine the specific production expansion schedule, by weapon system, that would be required to meet those force-expansion objectives. Those specific production buildup schedules would become targets. Requests for proposals for production of new systems would specify an expansion capability required to meet these targets. Consideration could be given to producing some items whose inventories exceed our short-term goals in order to keep the production base "warm," shortening the lead time for expansion. We would then evaluate other alternatives for meeting those schedules and would consider policies and decisions on such things as building and then laying away production facilities, purchasing item-peculiar tooling for stockpiling, and stockpiling long-lead-time components. The Office of the Secretary of Defense would work with the military services to ensure that acquisition policies, facilitization decisions in FY 1983 and on, and other policy and program decisions influencing industrial base response were designed to acquire the necessary production base expansion capability by no later than FY 1987.

In order to increase the stability of the process, the planning cycle, including the setting of force-expansion objectives, would be repeated no more often than once every three years. This specific industrial preparedness planning process should be a

<sup>1</sup> For example, during informal discussions among Kahn, Dr. William Perry, Dr. Richard Danzig et al., in Dr. Perry's office in 1980.

at a fairly high level in DOD (probably in the Office of the Under Secretary of Defense for Policy) staffed with a dozen or so talented defense policy and program analysts and economists. This is not a criticism of the people in the Office of the Secretary of Defense and elsewhere who have been trying to grapple with this problem in the past. However, I think they would be the first to admit that they have not had adequate numbers of people with the proper analytical skills and talents to address the problem at hand. This office might in some ways closely resemble the Defense Mobilization Policy Office that Herman Kahn has advocated.<sup>3</sup> However, I would envision their task to be more systematic and structured than some of Kahn's descriptions of his proposal would imply.

These high-quality staff resources are obviously necessary for any successful attack on this problem, but they are far from sufficient. The single, absolutely essential ingredient is a statement from the most senior level of the Defense Department of the objectives of the defense industrial preparedness program, and a real commitment to dedicate the time, staff talent, and defense program resources to make it happen. Not to take this step would mean that we would continue to have an inadequate industrial base. **DMJ**

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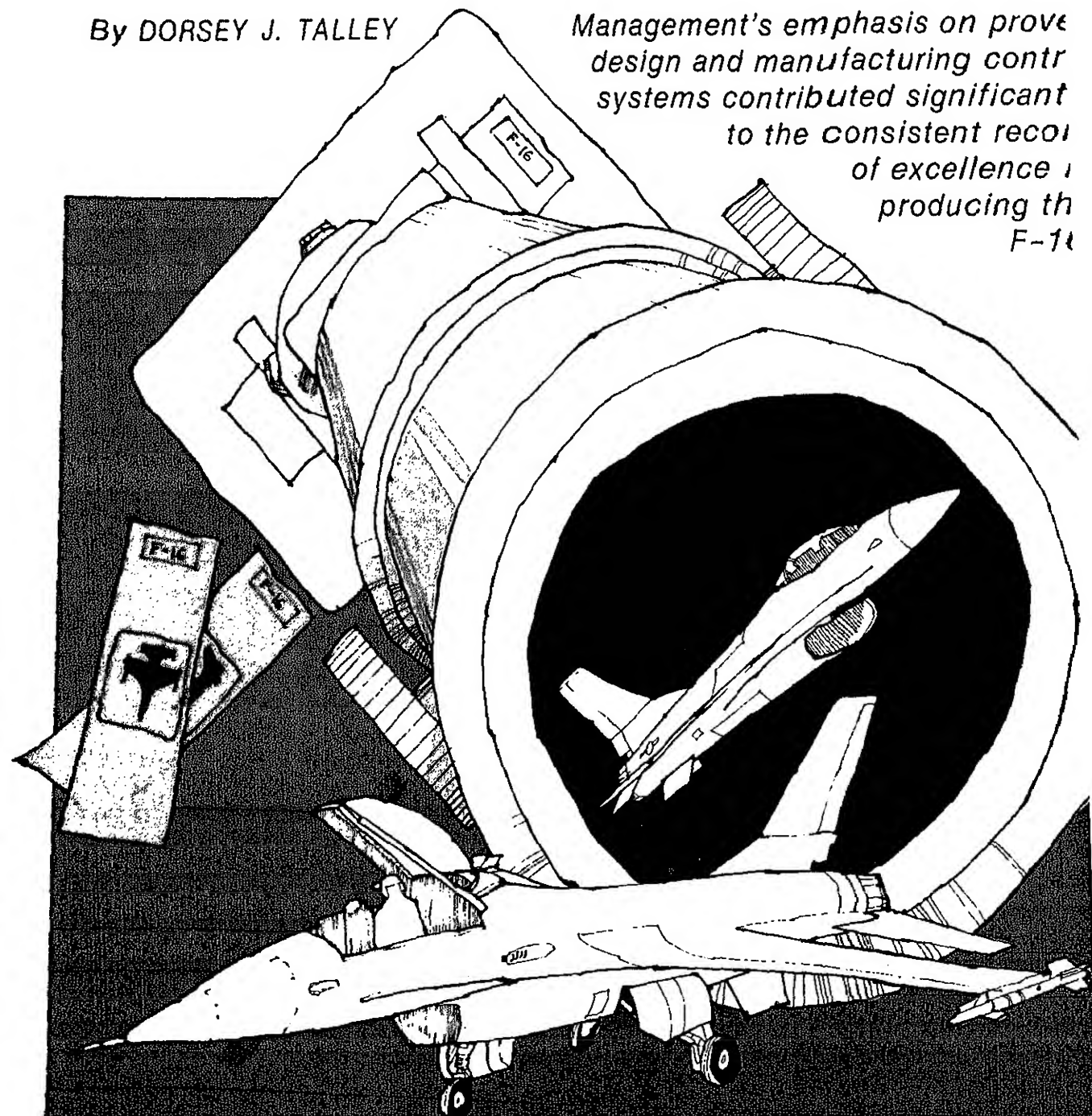
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# Once gained, twice lost Micromanaging the perfect aircraft

By DORSEY J. TALLEY

*Management's emphasis on prove design and manufacturing control systems contributed significantly to the consistent record of excellence in producing the F-16*





accepted delivery of a perfect F-16 multirole fighter aircraft from General Dynamics' Fort Worth manufacturing division. After a rigorous series of ground and airborne tests and inspections, contractor and government acceptance teams found the aircraft free of even minor defects. The significance of the event was enormous. Never before had a military aircraft of such complexity attained this level of acceptance.

This F-16 was not a prototype or uniquely manufactured model. It was a routine production aircraft containing many major components manufactured and delivered by General Dynamics' European co-producers. The manufacture of the aircraft was marked by the same processes, standards, quality requirements, and schedule demands imposed upon all F-16 production models. The aircraft was different only in that it was perfect, that is, it displayed no discrepancies during the company test flight, no discrepancies during the Air Force acceptance test flight, no discrepancies during the Tactical Air Command ferry flight to the aircraft's destination, and zero discrepancies on the intensive receiving inspection at Hill Air Force Base, Utah.

For General Dynamics, its co-producers, suppliers, vendors, and the accepting government agencies, this delivery was an aircraft manufacturing milestone. They realized that attaining this degree of excellence would prove a difficult act to follow.

In subsequent months, however, responsible systems management made possible some suitable encores. Although delivery of another perfect aircraft did not soon follow, the contractor, suppliers, co-producers, and accepting government agencies did produce an impressive number of zero-defects aircraft (see figure on p. 10). Although some problems were apparent during contractor-government test flights, the aircraft were pronounced defect-free upon inspection at their delivery sites. By December 1980, 67 zero-defects aircraft had been delivered. Of those, 23 were produced consecutively. In addition, 57 other delivered aircraft displayed only minor discrepancies.

None of this happened by chance. Management's emphasis on proven design and manufac-

systems to minimize end-item deficiencies in the F-16 production program. These were principally in the areas of defect visibility, corrective action, and configuration verification.

Early detection of defects, which allows a manufacturer to define adverse trends and identify root causes, is mandatory in controlling the production quality of any sophisticated weapons system. Production of the F-16 requires more than 19,000 parts, 23,000 operations, and 100 special processes. Monitoring such a production process requires the most accurate, high-speed defect analysis program available. The program developed at Air Force Plant Four (General Dynamics' Fort Worth division) is meeting this need. Early detection of potential or real-time hardware deficiencies allows prompt preventive and corrective action. Similarly, daily monitoring for adverse or repetitive defect trends promotes quicker response in identifying the primary causes and correcting the problems.

General Dynamics' management system for defect visibility incorporates a completely computerized program for recording and displaying defects as they occur anywhere in the manufacturing facility. Strategically located data-input and print-out terminals provide instant access for analysis, tracking, and closure purposes. In addition, an elaborate defect coding process offers immediate identification and recall by defect code, type, aircraft, assembly, component, work station, or any combination of these elements. Up to one year of historical data on a defect can be quickly retrieved from the computer, and older data can be obtained from company archives. As a result, everyone from the floor inspector to top management has almost instant information on outstanding and corrected hardware defects.

The Air Force Plant Representatives' Office was also successful in collecting more detailed data on deficiencies detected at the field level. Originally, technical orders required only that the field report major and critical aircraft defects. The Air Force Plant Representatives' Quality Assurance Office and Headquarters Tactical Air Command rewrote, streamlined, and compiled these requirements into a maintenance operating instruction, which



## Micromanaging the perfect aircraft

tiated the revised requirements with individual Air Force bases, and thereafter defect reports began flowing back to the plant for immediate preventive action. The benefits of increased input from the

field were reflected in a lower defect trend.

A second key management system is General Dynamics' corrective action program. This system prioritizes defects by segregating significant deficiencies for concentrated analysis and correction and deferring minor ones for collective analysis and resolution. Defects qualify for concentrated analysis and correction if they are selected at Management Material Review Board or Air Force Quality Assurance Office request, affect producibility, exceed established norms or standard repair limits, or result in high-dollar scrap or high-dollar rework or repair.

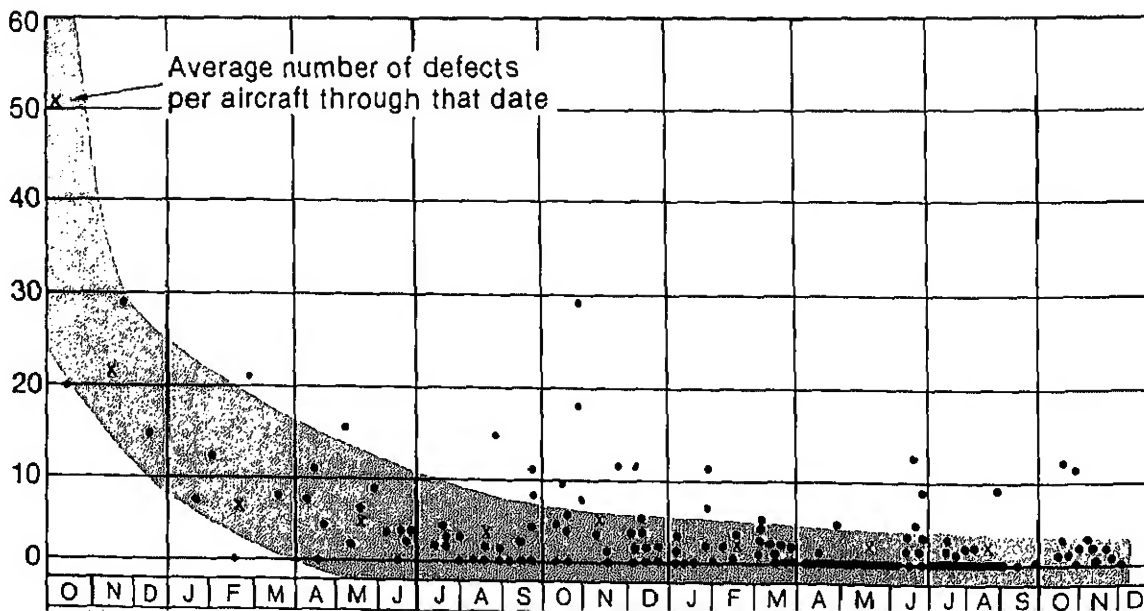
Corrective-action specialists review defects in these categories to determine cause, assign responsibility for correction, review and approve corrective action, and obtain AFQAO concurrence. The assignee then directs correction of the problem, ensures timely correction, and records the results.

Defects designated by the Management Material

### The quality of production of the Air Force's F-16

Between October 1978 and December 1980, General Dynamics' Fort Worth division produced 178 F-16s. Upon inspection at their delivery sites,

67 of those aircraft were pronounced defect-free and 57 others displayed no more than four minor discrepancies.



for resolution. This board, comprised of General Dynamics managers and government representatives, is responsible for overseeing the entire non-conforming material and corrective action system. The corrective action assignees handle less critical defects at the factory floor level. Minor defects are also monitored at the office level to identify the corrective action needed and to advise management of the status of that action. When such defects become repetitive or otherwise impact cost and schedules, they are reassessed and management is advised.

The corrective action system includes a final review of each action taken to assure that the prescribed solution is effective. If it is not, the action is referred to the Corrective Action Board for prompt, upper-level resolution. The number of rejections per aircraft provides some measure of system success. The current 5 production aircraft averaged 75 rejections per ship; the first 5 averaged 395 per ship.

Perhaps the key element in achieving minimal defect deliveries has been the General Dynamics-AFPRO approach to customer liaison. *Talking to the user* has been a fundamental management concept since the program began. Familiarizing Air Force maintenance personnel with F-16 manufacturing and assembly techniques has opened new channels of communication which are helping the manufacturers to produce a better aircraft.

The Tactical Air Command's Crew Chief Program is one example of the success of this approach. Under this program, crew chiefs receive orientation at the manufacturing facility 7-10 days prior to aircraft delivery. This orientation includes a plant tour that begins with initial raw stock machining operations and proceeds through each major assembly phase leading to aircraft completion. The tour gives the crew chief a detailed overview of aircraft production and processing operations.

At the point of final assembly, before access panels are in place, the crew chief observes a thorough aircraft inspection. He also sees the system in operation, including setup and activation of required support equipment, and receives a briefing on the system's functional components

test and checkout steps necessary to qualify the completed aircraft for flight.

Both user and manufacturer benefit from this orientation program. The crew chief gains a more thorough, hands-on familiarity with the F-16 than any presentations or classroom courses could provide. He also is able to share his knowledge with

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*Early detection of defects, which allows a manufacturer to define adverse trends and identify root causes, is mandatory in controlling the production quality of any sophisticated weapons system.*

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other user echelons. Similarly, the production team is able to better appreciate customer needs, ranging from routine maintenance and servicing to on-line operational requirements.

These exchanges also have great potential for improving design, manufacturing, and quality criteria. So successful has the AFPRO crew chief program been that General Dynamics and AFPRO are negotiating an expanded program that would reach other Air Force user facilities.

Configuration verification has also been an effective management tool in producing defect-free F-16s. It is a computerized system that tracks and verifies installation of engineering changes, and it is totally compatible with co-producer systems. The success of this system led NATO offices to use it as a model in developing their own configuration verification specifications.

Other management systems were also important in making a defect-free F-16 possible. They included an emphasis on aircraft maintainability early in the design process; computerized planning operations; heavy government and contractor emphasis on advanced manufacturing technology programs; and ongoing review, update, and streamlining of inspection operations.

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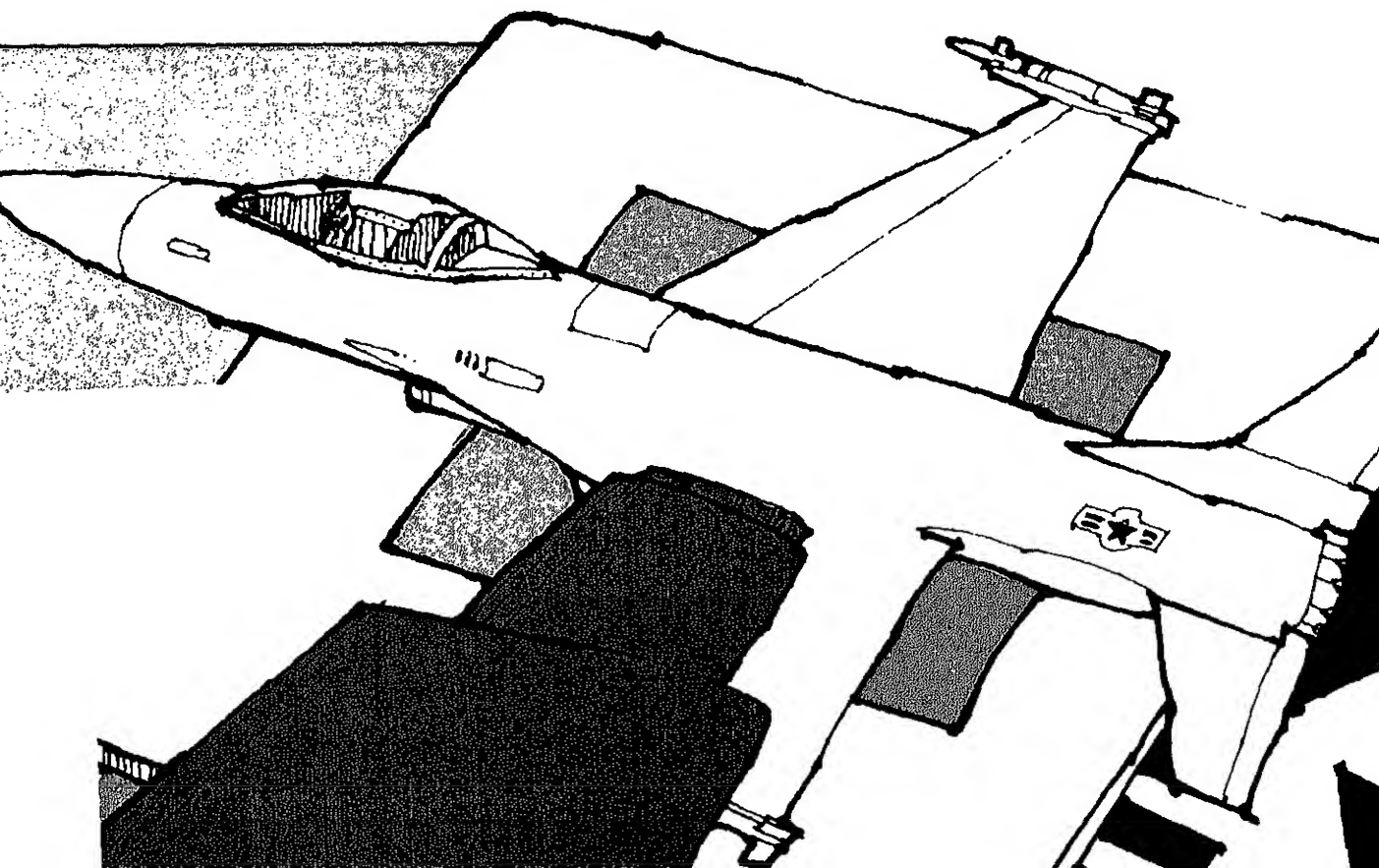
- A successful cost reduction and employee suggestion program, which was responsible for improving aircraft quality while at the same time reducing manufacturing costs.

- A system of open communications and briefings that kept personnel aware of production progress and promoted team spirit.

- A product discipline program that allowed employees to share responsibility for monitoring production operations in individual work areas.

These and other programs to encourage excellence were the product of a single management philosophy, perhaps best expressed by General Dynamics' Fort Worth manager of Quality Control-Field Operations: "We must remember not to be satisfied. Early in the program we visited the using commands to find out how we could give them

team at Air Force Plant Four was able to better understand how they achieved a perfect airplane. Though they were not able to retrace the exact sequence of steps that resulted in the perfect aircraft, they were able to discover some clues in other pro-



tenance workers in the mechanical and electrical shops. We're still talking, learning, and communicating with them and our own team to keep on improving the product. We will continue to improve it as long as we're not satisfied—and we're not satisfied yet."

In keeping with this philosophy, General Dynamics' Fort Worth contractor and government agencies continue to look for ways to improve production in many areas. For example:

- *Inspection systems and techniques* are continually under review in an effort to make them more economical and effective. Joint quality and manufacturing technology studies are under way to determine the feasibility of introducing new techniques and additional automated inspection equipment.

- *Customer and co-producer liaison* is being streamlined through an improved one-time inspection procedure and material survey system. The Air Force Plant Representatives' Office plans to negotiate more detailed aircraft inspection requirements at other facilities, and expanded crew-chief orientation also promises improved liaison capabilities.

- *Expanded product visibility* is being sought through evaluation of the latest gains in computer technology. Voice data inputs, optical scanning, and system reviews by outside consultants are some of the methods being considered to achieve more

Though improved management techniques are important, the General Dynamics' Fort Worth team realizes that the current level of excellence is also the product of the people involved in the F-16 program. They include suppliers, co-producers, government and General Dynamics' Fort Worth employees.

General Dynamics' initial success with the F-16 has strengthened the commitment of management and employees alike to increase the percentage of zero-defects aircraft deliveries. This commitment to excellence and a management philosophy of ongoing improvements in production may be the key to producing the second perfect aircraft.

### Addendum

On May 13, 1981, General Dynamics' Fort Worth Division delivered a second perfect F-16 to the United States Air Force. Like its perfect predecessor, this production model F-16 met all performance standards without a single discrepancy. It was also a truly multinational aircraft. Though the plane was assembled in Fort Worth, its aft fuselage came from SONACA in Gosselies, Belgium; its wings were made by SABCA in Brussels, Belgium; and the vertical fin was manufactured by Per Udsen in Grenaa, Denmark. The numerous parts and subassemblies of the aircraft were manufactured by several co-producers.

Production of this second perfect aircraft was a source of pride for every member of the F-16 multinational team and an additional incentive to continue their pursuit of product excellence. **OMJ**

*Gordon*

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*DORSEY J. (JIM) TALLEY is Vice President, Quality Assurance, at General Dynamics' Fort Worth, Texas division (Air Force Plant Four). He holds several pilot ratings with over 7,000 flying hours and is retired from the U.S. Air Force with the rank of colonel. He previously served as Air Force Plant Representative at General Dynamics and Rockwell International. Mr. Talley holds a bachelor's degree in engineering from Texas A&M and a master's degree in logistics and industrial management from the Air Force Institute of Technology.*

# For energy conservation

By CAPTAIN ROBERT E. MUMFORD, JR., USN (Ret.)



*Achieving a successful energy conservation program is a task for engineers, managers, and building occupants alike.*

cert with unscrupulous politicians and bureaucrats. Today, in the aftermath of the Iraq-Iran war, escalated oil prices, and a plethora of research and the resulting attention in the media, few doubt that energy consumption is a genuine problem of immense proportions.

The implications of the situation for the Department of Defense are of similar proportions and require serious attention. Every weapons system employed by DoD consumes energy, and many have gargantuan appetites. In fact, Defense is the largest single energy user in the United States, consuming some 168 million barrels of oil each year. Without that oil, the military machine would become little more than the "pitiful, helpless giant" of legend.

How has DoD responded to this situation? Defense managers have moved along many fronts and tried a variety of approaches. This article will review recent progress toward solving the problem within DoD, offer some examples of conservation efforts that have succeeded (and some that have failed), and propose a model energy conservation program that can help Defense installations get the most out of scarce energy resources.

DoD has taken measures both to assure adequate fuel supplies for the future and to conserve supplies already available. Our four-point supply assurance strategy involves the acquisition of secure domestic crude oil sources, the guaranteed purchase of synthetic fuels when commercially available later in this decade, simplification of petroleum procurement practices to enable us to compete better in the marketplace, and development of regulatory procedures that assure priority allocation of petroleum when fuel shortages threaten readiness. In addition, we have improved our storage and stockage policies to ensure that both reflect current energy realities. In cooperation with the Department of Energy, DoD has also demonstrated a number of renewable energy systems, including those that use solar energy, photovoltaics, wind, biomass, geothermal, and fuel cells.

On the conservation side, we have research and development efforts under way to discover alternate and more efficient methods for operating equipment and to improve the efficiency of aircraft

All those efforts are essential and commendable and will result ultimately in more, and perhaps cheaper, readiness per unit of energy consumed. Mandatory reductions are the final element of DoD's energy conservation program. The reductions are, by necessity, broad brush, but very explicit: a 20 percent per square foot reduction in energy consumption (expressed in BTUs) in existing buildings and a 45 percent reduction in energy use per square foot in new buildings by 1985. The latter goal is primarily, but not exclusively, a design problem for architects and engineers. The former—on which we will focus our attention—is largely a problem in management.

In setting the reduction goal for existing buildings, DoD estimated that 60 percent of that goal, or 12 of the 20 percent savings directed, would require central funding for retrofit projects. The department earmarked retrofit funds for the energy conservation investment program to finance installation of insulation, weather stripping, storm windows, energy-efficient lighting, and other capital-intensive projects. The other 40 percent of the goal for existing buildings (8 of the 20 percent reduction mandated) was to be achieved through low-cost and no-cost measures at the local level.

In the meantime, much evidence accumulated in both the public and private sectors that the 60-40 split was much too conservative. The author believes that most local installations can achieve the full 20 percent reduction through low-cost and no-cost conservation measures. But assuming for a moment that our initial 60-40 estimate was correct, we should now have accomplished all of the reductions through low-cost and no-cost efforts, or 8 percent, in addition to half the retrofit reductions, or 6 percent, for a total of 14 percent. Or, using a straight line projection of 2 percent per year since FY 1976, we should have reduced consumption by 10 percent by the end of FY 1980.

How have we actually done? Overall, DoD is down 7.5 percent, with the individual service records as follows (The figures represent straight energy reductions, not BTUs per square foot; square footage data is under revision and currently unavailable.):

- Air Force—down 11 percent.
- USMC—up 0.3 percent.

Why the shortfalls? On almost every base the author has visited during the past 18 months, energy conservation has not received the attention it deserves. There is an abundance of policy, but little enforcement and few incentives. Here are some examples from my experience:

- One base had posted a big sign stressing energy conservation just inside the main gate; on it were some figures indicating progress toward energy conservation goals. I was impressed until I drove further and saw what looked like geysers—steam was coming out of the ground in every direction. Base personnel told me that they just did not have enough money to repair all the steam leaks. But I wondered just how many dollars were being wasted each year in energy venting to the atmosphere.

- On another trip I was waiting for an aircraft and got to talking with a retired colonel who spends a good deal of time travelling space available. He told me that he had yet to stay in a BOQ where the temperature in his room was comfortable. It was always too hot in the winter, usually above 80 degrees, he estimated. Though not too interested in energy, he was annoyed at the discomfort and the waste.

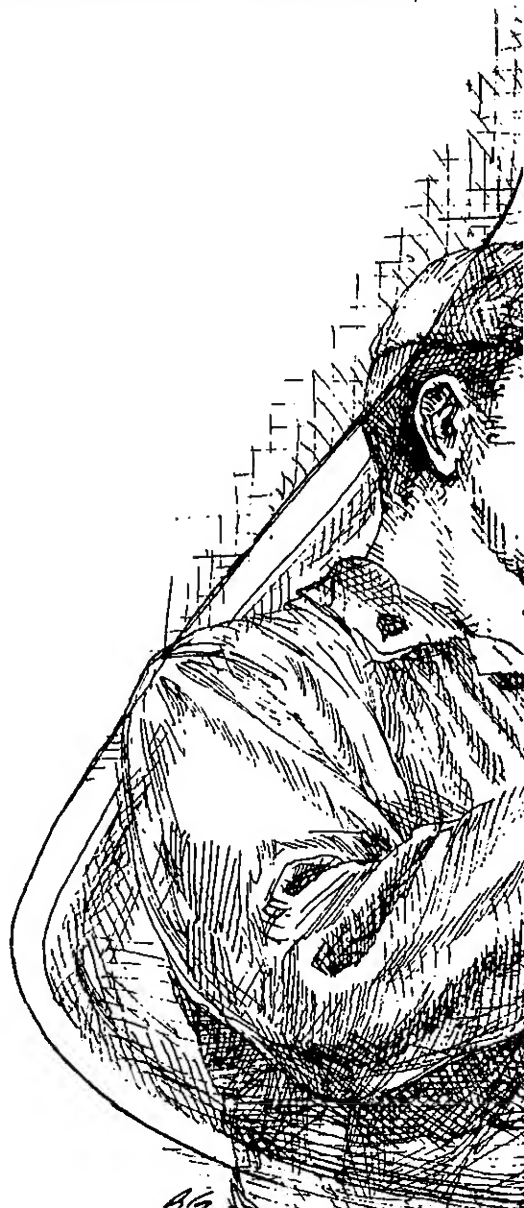
- On another occasion, at an air station on the east coast, I was chatting with an air crewman in one of the hangars; it was a very cold, predawn morning and I noticed a draft. Upon investigation, I found out that all the windows in the hangar had storm windows, but none had been calked and so had huge gaps. The government had spent thousands of dollars on that retrofit job and were not getting a single benefit because the job had not been finished properly.

- One final example illustrates some other problems that can frustrate conservation efforts. While at an airbase, I asked an air crewman chief what he thought of energy conservation on the installation, and he passed along some interesting information. (Incidentally, the base had a good reputation for energy conservation.) He told me about a hangar door which the crew had to leave open because a

with the emphasis on turning out porch lights in the housing area. He had become an energy cynic, not a greatly endangered species in today's world.

Can we point to any successes to offset these failures? Yes, in several instances, command-level personnel have demonstrated interest in and supported innovative programs:

- Shemya Air Force Base, an outpost at the extreme end of the Aleutians,





White House. Under the command of Lt. Col. Richard J. Guertin, Shemya reduced motor gasoline consumption by about 25 percent and diesel fuel by 49 percent during a special year-long program which emphasized motor fuels as well as building energy.

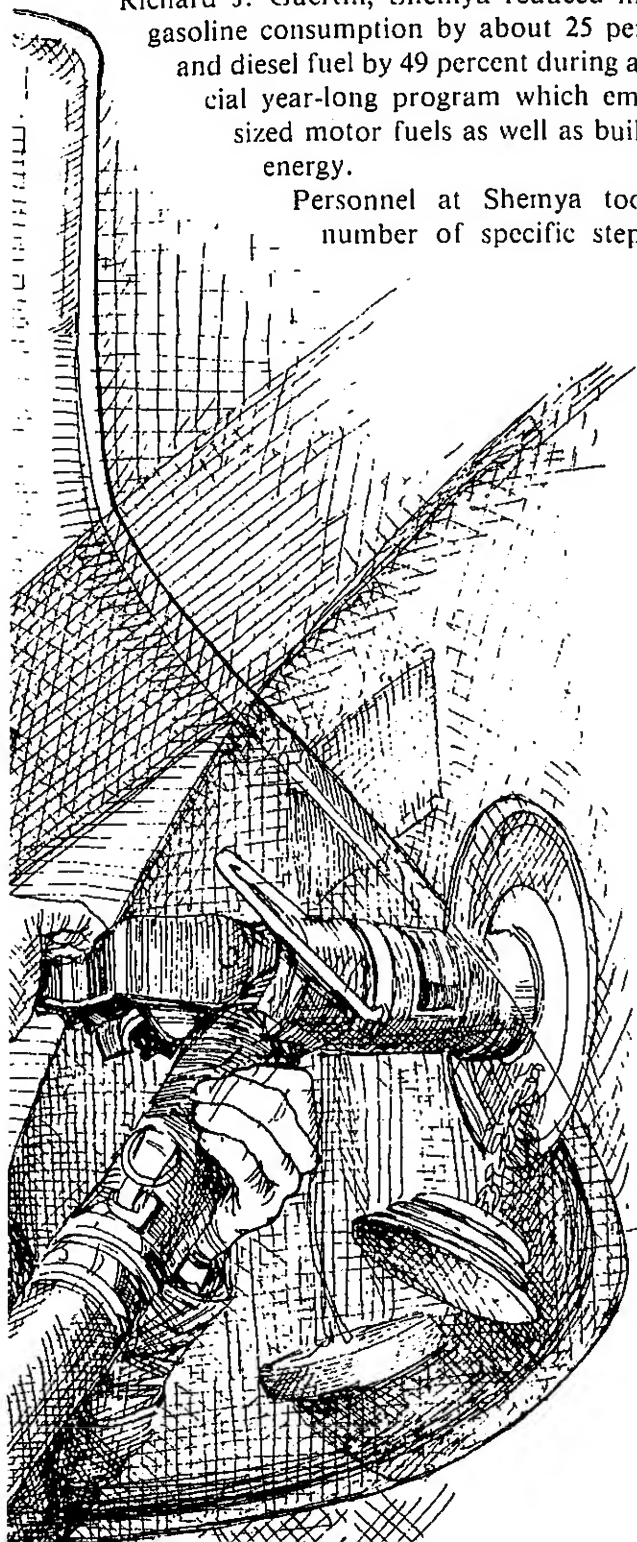
Personnel at Shemya took a number of specific steps to

fuel efficiency, encouraged people to walk or use mass transportation, assigned fuel quotas to vehicle operators, stressed good maintenance, and removed extraneous material from auto trunks. In short, energy efficiency became a way of life for the airmen at Shemya, and its program shows that people can make enormous contributions when the right conditions are present.

- Officials at Fort Bragg have instituted several measures to encourage conservation. Classes are conducted to acquaint troops with the cost of energy and what can be done to save. Inspection teams check for compliance with installation policy, and cash awards are given to the highest-rated battalion and company. Next heating season, plastic temporary storm windows, a low-cost but effective measure, will be required on all barracks.

- At the Navy's Pacific Coast SeaBee base, Port Hueneme, California, the commanding officer acted on the axiom that the "highest technology is still dependent on the person closest to the switch." Recognizing that retrofit monies were difficult-to-impossible to obtain in the short run, Port Hueneme decided to see how much energy it could save at the local level in one year. Base officials designated the public works officer as energy conservation officer, formed a board of senior managers from each department and tenant at the SeaBee Center, and appointed an energy manager for each building. These were working organizations. They did not merely pay lip service, as the results—a 17.4 percent energy savings in 1980—attest.

- Among many other successes at the local level, two more examples will suggest something of the diversity of approaches to the problem. Capt. Jim McEvoy initiated a particularly successful energy conservation program for the base elementary school at Little Rock AFB. His thinking was that grade school is a good place to begin acquiring the conservation ethic which is essential to the country's energy future. At Scott AFB, Col. Lavens Folts used a low-key, soft-sell approach to begin and support several worthwhile programs. "Black Thursday," for example, was a gimmick, but a successful one, for minimizing energy use on one day of the week to teach everyone how energy



and sustain the momentum already achieved? A management system that motivates individuals is the key and also the challenge that DoD managers face. Before considering a model for energy conservation programs, we therefore need to review some fundamentals about human motivation.

Frederick Herzberg, who has done research in the field for a number of years,<sup>1</sup> categorizes the various elements that affect or are part of a person's job as either motivators or "hygiene factors." In the latter category he includes elements such as organizational policy, the work environment, working relationships, and salary. Among motivators—elements that enhance or inhibit productivity—he lists opportunity for achievement, responsibility, and authority; recognition for accomplishments; the opportunity for personal growth on the job; and the challenge of the job itself.

Herzberg emphasizes that the hygiene factors cannot motivate people to work, but their absence can demotivate people. Therefore, we as managers cannot ignore the hygiene factors, but we should not expect motivated employees just because we try to provide good working conditions, relationships, and pay. Our management systems must also offer opportunities for achievement, responsibility, and recognition, if we want something more than what Herzberg calls "movement" from employees. "Movement" describes those things people do merely because they are told to, not out of any conviction that those actions are most likely to produce results. Though managers want initiative, creativity, commitment, and enthusiasm, they often set up or maintain systems that reinforce "movement."

David McClellan is a Harvard professor, who, like Herzberg, has spent essentially his entire professional life examining motivation.<sup>2</sup> McClellan

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<sup>1</sup> See, for example, his article entitled "One More Time: How Do You Motivate Employees?" *Harvard Business Review*, January-February 1968, pp. 53-62.

<sup>2</sup> Among his articles on the subject are "Achievement Motivation Can Be Developed," *Harvard Business Review*, November-December 1965, pp. 6-16, 20-24, 178, and one written with David H. Burnham, "Power is the Great Motivator,"

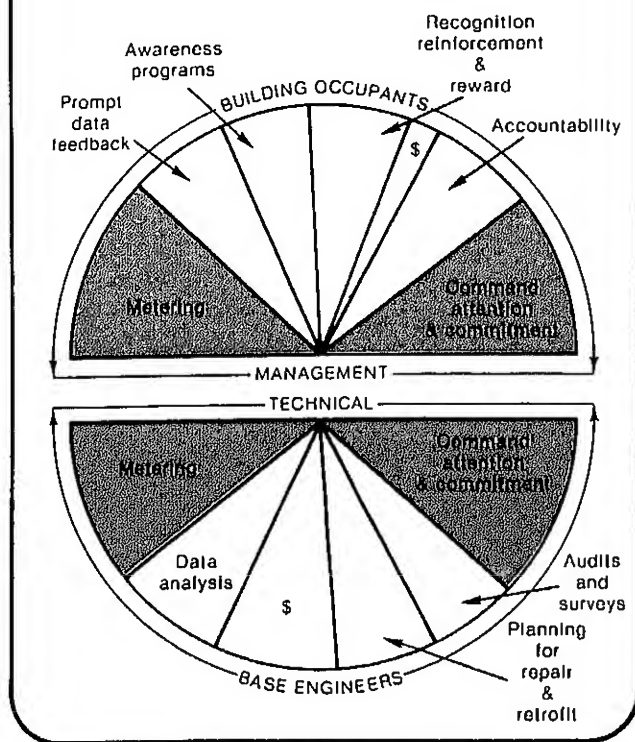
concerned with prestige, status, and influence on others. Affiliation refers to relationships with others—some people work most effectively when able to interact on a semipersonal basis with colleagues on the job. People motivated by achievement do best when given goals that stretch them to do things better, faster, or more efficiently. They respond to performance feedback; specific, challenging goals; clearcut standards of success; and personal responsibility. Energy conservation is an achievement goal.

We have all three social motives with varying degrees. According to McClellan, though in varying degrees, and even individuals respond differently to each, depending upon the time and circumstances. But each of us does have a motivational profile, which indicates our basic orientation, and, generally, which motive in the profile is stronger than the others. Most successful managers, for example, are high in both power and achievement and low in affiliation.

The profile, however, is not fixed and does not change easily. If employees are low in achievement, for example, McClellan's research has shown that managers can build up that motive. By setting up a management system that provides well-defined goals and standards, clear lines of responsibility, authority, and a built-in mechanism for feedback on performance and for recognition of achievement, managers have been able to strengthen the achievement motive in their employees. The results are very reassuring because they show that if we do not have to accept low productivity, we can actually change peoples' work output in the desired direction. However, the process is neither simple nor rapid. It involves dealing with ingrained habits, resistance to change, and low expectations for personal fulfillment. A management system that changes may well take a year or more, but the resulting greater productivity can be well worth the effort.

What do Herzberg's and McClellan's findings have to do with saving energy? A great deal. As we realize that the challenge of energy conservation during the next few years does not lie in the development of esoteric technology. Rather, it is a matter of implementing and enforcing widely known principles. Reduction of energy consumption by 20 per

## energy conservation program



known technology and at relatively little expense. Managers need only motivate their employees to use means already available.

The author has heard many times in his travels that base A or installation B has done everything possible to achieve energy efficiency and that additional savings are possible only through projects costing thousands of dollars. Such assertions are generally just not true. On virtually every base—even those that have already accomplished much—more remains to be done. DoD managers need to think in terms of creating an environment that will motivate employees to achieve energy conservation goals. Several of the examples discussed earlier demonstrate the real savings possible with an effective management system focused on energy conservation.

The figure on this page offers a model for an effective energy conservation program. It is a two-part effort, which is designed to create an effective

profligate energy habits and establish new, energy-responsible habits in their place. Though the engineers, who are addressing technological problems, require substantially more money, proper levels of funding are necessary for both. Even more critical to success at both levels, given a military environment, is command support.

Perhaps more easily overlooked, but nonetheless critical to the efforts of engineers and occupants alike, is metering. In the past, no doubt because of their cost, meters have been controversial. A common argument against them is that they do not save any energy. This objection is narrowly accurate, of course, but by analogy, cash registers do not make money either. Yet who can imagine trying to run a department store without them? Regardless of whether the store were making or losing money overall, no one would know precisely where the profits or losses were occurring.

Meters serve much the same purpose as cash registers, yet most base commanders are trying to manage energy with master meters at the fence, which record gross consumption but do not specify where it is occurring. Work goes on, engineers retrofit buildings, employees are exhorted to save energy. But who is saving and who is wasting are not known. A Navy utilities officer stated the problem well:

*Building managers know that their consumption patterns are undetectable and can procrastinate, or even avoid, enacting energy conservation measures which are necessary, but which may take time and effort, or be unpopular with other building occupants.*

Within DoD, the engineering part of the proposed model has received much attention, as have certain elements of the management portion—awareness activities, for example, and recognition efforts. The most glaring omissions in base energy conservation programs have been in the areas of data feedback and accountability, both of which depend upon metering to be fully effective.

Giving all personnel information on how the installation is performing overall is not nearly as effective as furnishing data to a building's occupants concerning their building's record. An inverse relationship exists between the two. The more information

occupants and their consumption patterns will enhance energy conservation efforts.

Accountability is impossible without meters. We can put a person in charge of every building, but without finite data to measure his performance, we cannot hold him accountable. Meters allow us to recognize and reward the successful, encourage the laggards, and take appropriate action against those who are clearly not making the proper effort. The competitive drive is keen in many Americans, and if comparative data on other buildings is available, data alone will motivate many people to conserve.

The behavioral principles underlying the model, of course, are those of Herzberg and McClellan. The program depends upon Herzberg's motivators—responsibility, opportunity for achievement and personal growth, the challenge of the job, and recognition for success—to stimulate people to conserve. Finding ways to use less energy is obviously a challenge, and accountability entails responsibility. By calling for specific goals and feedback on performance, the model provides opportunity for achievement, and command attention and recognition come with success.

McClellan found that the achievement motive is critical to effectiveness in the workplace. By creating a climate that reinforces that motive and deemphasizes the power and affiliation motives, the model recognizes that energy conservation will only be accomplished through achievement-oriented behavior on the job.

Achieving an effective energy conservation program is a matter of putting theory and research into practice. To implement the model, base or installation commanders should take the following steps:

- Vest clear-cut responsibility for each building on the base with one individual.
- Meter every building as soon as possible (start with electrical meters), provide consumption data to the person responsible each month, and make sure each building's occupants know how much energy their own and other buildings on the installation use each month.
- Survey every building to determine the adequacy of insulation, storm windows and doors,

tion once baselines of consumption have been established.

- Review progress periodically in one-on-one meetings with responsible subordinates.
- Hold the responsible people accountable, reward the faithful, and publicize success.
- Set up a suggestion system which the base commander reviews personally; ensure rapid decisions on suggestions.
- Be seen—inspect success, check progress.
- Establish an energy conservation training program for vehicle drivers.
- Actively promote conservation—sponsor an "energy day," for example, to educate people through literature and exhibits; have everyone weatherstrip their own windows on this day.

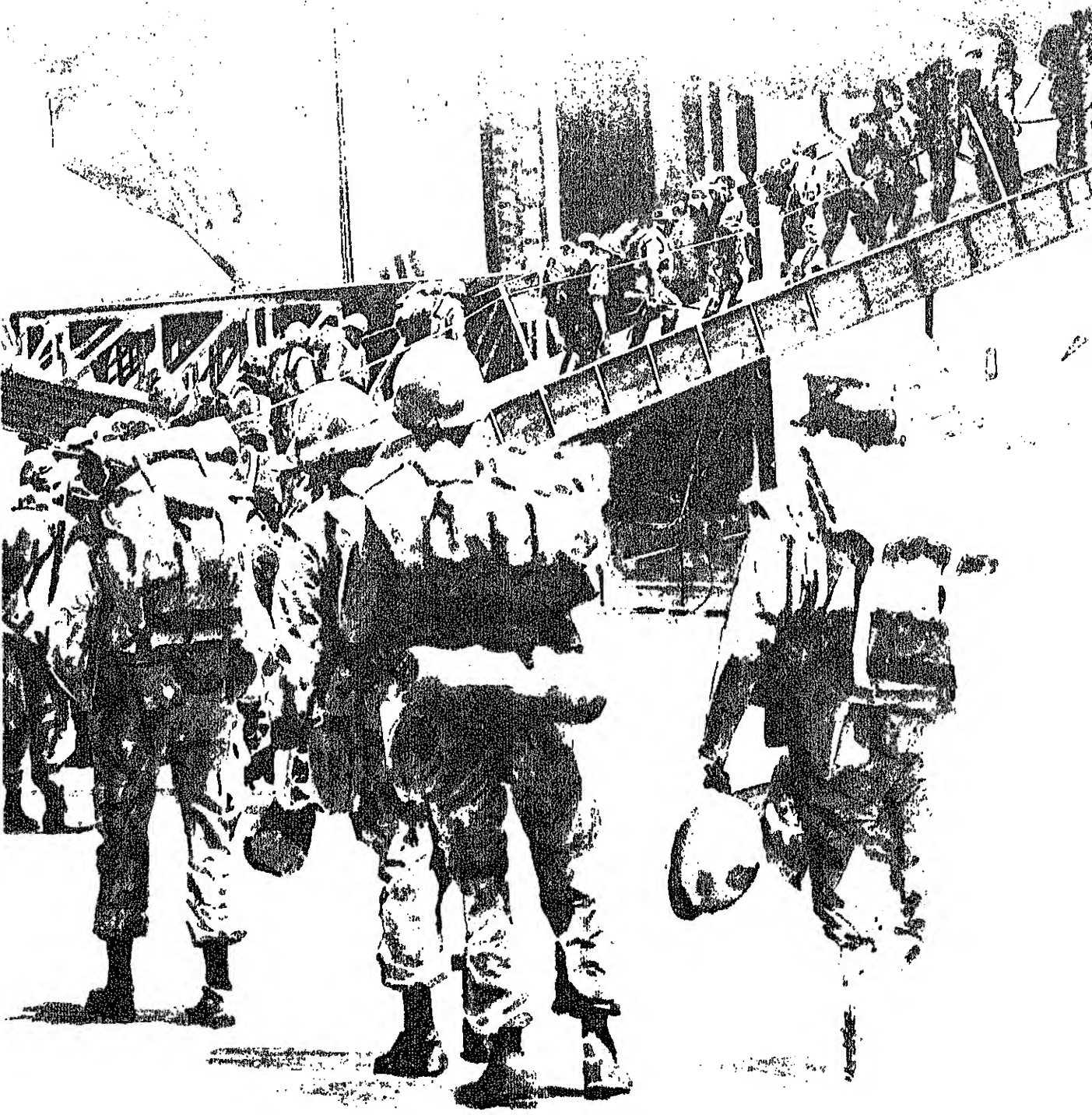
By taking these and similar steps, we can not only meet our 20 percent reduction goal but also help overcome counterproductive elements in the entire management system. These elements thwart our efforts to make saving energy a way of life. Energy conservation seems to be one of those motherhood things that everyone is for in the abstract, but something that most hope their neighbors will do. With solid command support and committed leadership, that need not be true. People can make enormous contributions to energy conservation, and managers can motivate them to enthusiastically support conservation programs. That is our challenge. **DMJ**

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*CAPTAIN ROBERT E. MUMFORD, JR., USN (Ret.) served as the assistant for energy conservation in the Office of the Deputy Assistant Secretary of Defense (Energy, Environment and Safety) from August 1979 until July 1981. In that position, he was responsible for energy policies affecting some 400,000 buildings and 2,000,000 people in the Department of Defense. Captain Mumford is a graduate of the Army War College and holds a bachelor's degree from the University of Rochester and a master's degree from the University of Colorado.*

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By MAJOR GENERAL W. STANFORD SMITH, AUS (Ret.)



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In 1973, the Department of Defense was confronted with two major new policies—the all-volunteer force and the total-force policy. Although those policies significantly challenged manpower management for the Reserve forces, today's management initiatives are achieving important results in reversing the shortfalls in Reserve forces strength. Nonetheless, serious problems remain.

Although the citizen-soldier concept is as old as the Republic, the total-force policy and the all-volunteer force have placed even greater reliance on the National Guard and Reserve than ever before. Half of the nation's combat power and two-thirds of its support capability are maintained in the Reserve forces. Simply stated, deterring our potential adversaries depends significantly on maintaining both the strength of these forces and providing a correct perception of this strength.

Public discussion of the real capability of these forces has been obscured by overstatements or understatements concerning their strength problems and by generalizations which fail to differentiate among the major components of the Reserve forces. Even within the Department of Defense, some mid-level management personnel draw erroneous inferences about the entire Ready Reserve based on the severe decline in strength of the Individual Ready Reserve. A realistic analysis of the strength of the Reserve forces must examine and evaluate the individual Reserve elements.

The Ready Reserve now has a strength of about 1,300,000 personnel, with a personnel strength of units in the National Guard and Reserve of 800,000. A fact often overlooked in public discussion is that these units train regularly and comprise a force that is bigger than the active armies of France and West Germany combined.

The other major element of the Ready Reserve is the Individual Ready Reserve. Historically, the size of the IRR has been a function of the size of the ac-

tive force, since individuals released from active service must remain in the IRR until the end of their six-year military service obligation. As large numbers of men were drafted during the Vietnam years, the IRR reached a strength of 1.5 million. Since this sum exceeded any foreseeable mobilization requirement, serious management attention was not focused on the IRR until the end of the draft and of the Vietnam war produced a sustained reduction in the IRR. Its greatly reduced strength remains a serious problem because it is the primary source of fillers for active and Reserve units and of replacements for early combat losses. However, care must be taken not to generalize about the IRR. It also must be examined in relation to its separate role in the air, naval, and land Reserve forces.

### *Air Reserve*

The Air Reserve forces present a textbook case of success for the total-force policy. Units of the Air National Guard and Air Force Reserve ended FY 1980 at all-time high strengths of 96,283 and 58,921, respectively. A measure of this success is reflected in the fact that these units have repeatedly demonstrated their capability to mobilize and deploy within 72 hours. Using the standards that are applied to active Air Force units, operational readiness inspections confirm the readiness of these units. Furthermore, the Air Reserve forces maintain interceptors and crews on an around-the-clock, peacetime-alert status. Air Reserve tankers also refuel Strategic Air Command bombers on a regular basis and sustain a contingent of fighter aircraft on alert status. Units in an associate program within the Air Force Reserve use active Air Force aircraft such as C-141s to perform needed peacetime missions as a by-product of training. Reserve crews who regularly fly such aircraft are indistinguishable from active-force crews.

One reason for the outstanding success of the



Air Reserve forces was early recognition by the Air Force of the essentiality of these units to the total force concept. The decision to assign adequate numbers of full-time personnel to the units—usually as much as 20 percent of the total strength—and to provide mission-related training has enhanced morale and contributed significantly to strength maintenance.

The principal strength problem of the Air Reserve forces is similar to that of the active Air Force: retaining highly skilled middle-management officer and senior noncommissioned officer positions. Retention of these highly skilled personnel is essential to maintaining the high levels of readiness achieved by the Air Reserve forces. Increases in pay in FY 1980 have helped, and planned future pay increases should assist in further reducing attrition.

The Individual Ready Reserve is a much less serious problem for the Air Force because of the strength and readiness of the Air Reserve forces. While the strength of the Air Force Individual Ready Reserve has declined in proportion to the decline in active Air Force strength, the IRR remains at about 46,000, a level sufficient to augment the Air Reserve forces by about 30 percent. Air Force tests have confirmed the service's ability to locate and issue recall orders to these personnel.

Strength of the Air Reserve forces since the end of the draft is shown in Figure 1 on page 24.

### *Naval Reserve*

The Naval Reserve has suffered from indecision within the Department of Defense as to the required strength of its Selected Reserve. Since 1972, five studies have reached varying conclusions about the Navy Selected Reserve's required strength. None of the studies recommended less than the current strength of 87,000. Nonetheless, for three consecutive years, the Department of Defense asked the Congress for a Naval Reserve strength of only 52,000. However, Congress rejected these recommendations and continued authorizing a strength of 87,000.

end of FY 1978, but this was rectified in succeeding years by a dedicated effort within the Naval Reserve.

By the end of FY 1980, the end strength reached 87,050. The Navy Selected Reserve is programmed to continue at approximately this strength until the end of FY 1983, when the new total strength will be set at 99,582. This strength increase will include counting full-time personnel of the Navy training

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*Employing challenging training, providing modern equipment, and recognizing the service of units and individuals also have contributed greatly toward heightening morale and increasing end strength.*

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and administration branch of the Reserves in the Selected Reserve. There is little doubt that the Navy can achieve this programmed strength.

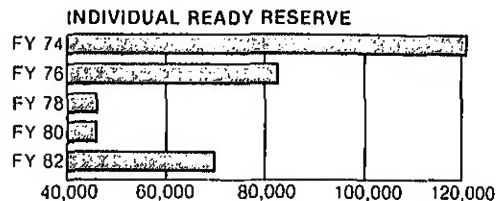
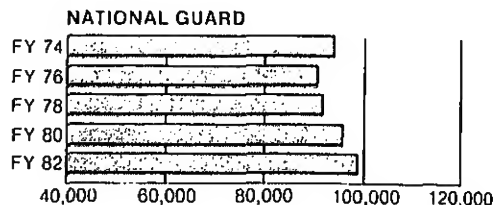
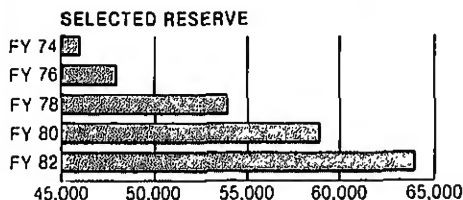
An important element of the Navy Selected Reserve is its air arm. Like its Air Force counterpart, this naval Reserve element has demonstrated a high level of combat readiness capability. The Naval Reserve's two carrier air wings have consistently proved this to the Navy and the Department of Defense. Similarly, Naval Reserve patrol units on both coasts have earned praise from their active Navy counterparts by consistently performing on a par with active fleet squadrons.

Admittedly, the Navy's Individual Ready Reserve has declined along with the decreasing strength of the active Navy. Today, the end strength stands at 97,000, a level that is capable of providing fillers and replacements to meet the pre-draft needs of the Navy. This level will allow the Selective Service System adequate time to draft inductees and provide the Navy with an opportunity to train them for additional fillers and replacements.



Units of the Air National Guard and Air Force Reserve ended FY 1980 at all-time high strengths. The principal strength problem of the Air Reserves

is the same as the active Air Force: retaining middle-management officers and senior noncommissioned officers.



the attraction of retirement under the Reserve retirement laws—will help solve this problem.

Strength trends of the Naval Reserve forces are shown in Figure 2.

### *Land-forces Reserve*

The land forces represent the most serious strength-maintenance problem in both the active and Reserve components. When DoD began implementing the all-volunteer force, it concentrated its energy and resources on manning the active force through financial incentives, more and better recruiters, and advertising. Only in the past two years has DoD made similar efforts to enhance recruitment and retention of personnel in the Reserve components. These steps were desperately needed by the Army to reverse its Selected Reserve losses of about 100,000 and its IRR's decline from a strength of more than a million to about 150,000 at the end of FY 1977. Fortunately, this picture is now changing significantly and favorably.

Those unfamiliar with manpower management often ask why the Army has more serious recruit-

to be the most dangerous form of combat. The other services also offer far more military occupational specialties with skills that can be more readily transferred to civilian life.

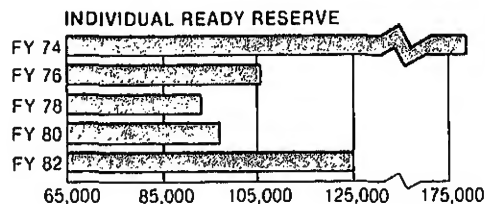
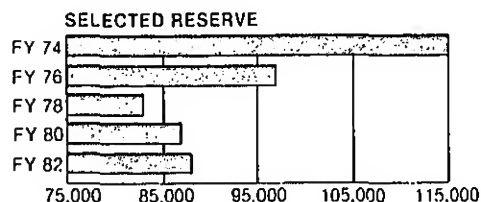
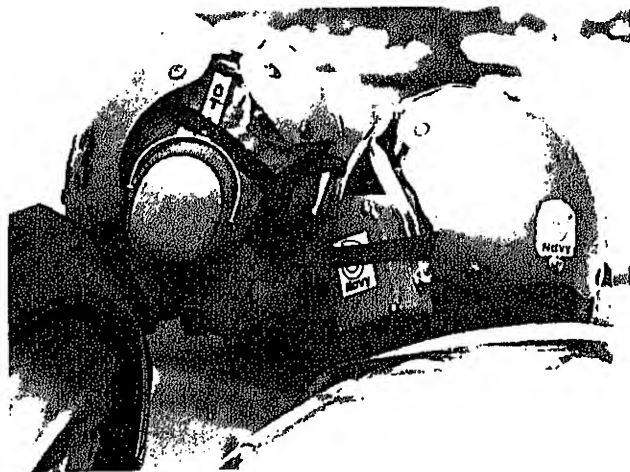
Sheer size is another reason why recruitment for the Army Reserves appears difficult. The Army Selected Reserve comprises approximately two-thirds of the total DoD Selected Reserve. If the Marine Corps Reserve is included, land Reserve forces total more than 70 percent of the entire Department of Defense Selected Reserve.

During the Army Selected Reserve's precipitate decline in strength, it was necessary to set intermediate strength objectives each year. Congress authorized and appropriated funds only for whatever strength seemed reasonably achievable. Given these circumstances, the Army could achieve 100 percent of its goal in a given year and yet make no progress toward eliminating its shortfall. Many observers failed to perceive the consequences of this approach or the effect it had on the Army's Selected Reserve status when compared to the strength level of the other services.

Cognizant of the need to rectify this situation,

The strength of the Navy's Selected Reserve has held fairly constant at its programmed level for several years. While the Navy's Individual Ready Reserve has declined considerably since

FY 1974, its current end strength should allow the Navy sufficient time to provide replacements to meet its pre-draft needs.



reach. This changeover follows significant improvements in the Army National Guard and Army Reserve strength over the past two fiscal years. In FY 1979, the Army began the turnaround in the strength shortfall of its Selected Reserve by gaining nearly 9,000 over its FY 1978 end strength. During FY 1980, the momentum increased when the Army Guard and Army Reserve strength increased another 37,700 (see Figure 3 on p. 26). Another gain of 9,400 was made in the first three months of the current fiscal year.

These gains are not attributable solely to financial incentives. To say that would be failing to recognize the enormous effort put forth by the Army Forces Command, the Army Recruiting Command, and the leadership of units throughout the Army National Guard and Army Reserve to reverse the negative recruitment and retention trends facing the Guard and Reserve. Employing challenging training, providing modern equipment, and recognizing the service of units and individuals also have contributed greatly toward heightening morale and increasing end strength.

Further gains in the number of drilling reservists

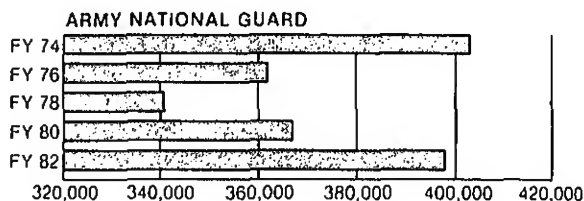
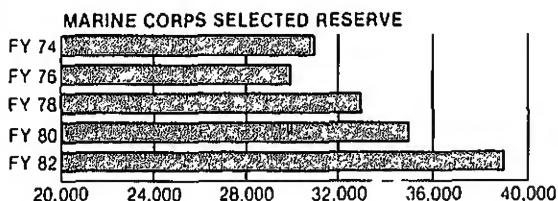
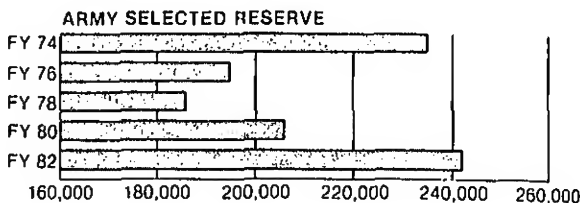
11,439 in the Army National Guard and 6,285 in the Army Reserve units. These increases will improve training, recruiting, and administration. The Air Reserve forces have proven beyond a doubt that full-time personnel help commanders provide an environment that supports and retains unit strength.

The Marine Corps Reserve is a significant element in the land Reserve forces that also has suffered strength problems. Like the Army, the Corps also has exerted a major effort to correct its strength shortfalls. Since FY 1976, the Marine Corps' Selected Reserve has been gaining slowly while maintaining its high standards of acceptance. The Reserve units' able performance under those high standards is visible during unannounced mobilization tests with active Marine units.

The greatest manpower problem lies in rebuilding the pool of pretrained personnel that provides fillers for land-force active and Reserve units and that replaces casualties in the early days of combat. The Army sets this requirement at 500,000. (Figure 4 on p. 27 shows the end strength of Individual Ready Reserve and Inactive National Guard land

In FY 1979, the Army concentrated on reversing the downward trend in Selected Reserve strength and gained nearly 9,000 individuals over its FY 1978 end strength. During FY 1980, the Army

Guard and Reserve added another 37,700 personnel. Further gains are expected by FY 1982 due to an increase of more than 17,000 full-time personnel in Guard and Reserve units.



power shortage because of varying estimates of early combat casualties and differing projections of the show rate of IRR personnel at mobilization. When these factors are evaluated, the shortage appears to be in the unacceptably high range of 200,000. Obviously, this shortfall in strength is extensive. This problem is further compounded because of military occupational specialty mismatches—a need for young combat-arms personnel versus an IRR of older personnel trained in diverse specialties.

However, there are other sources of mobilization manpower, including some 20,000 standby reservists. There also is the option to recall military retirees. Use of these personnel is a short-term expedient until DoD can implement a long-range program to increase to required levels the other elements of the pretrained manpower pool. Since 1978, initiatives to improve the pretrained manpower strength have resulted in an increase of about 75,000 individuals. New initiatives to build this pool require funding for enlistment and reenlistment bonuses. A test of direct enlistment into the IRR for initial training and assignment to the

Initiatives to improve the management of the Army's IRR can also contribute to reducing the net shortage of personnel for mobilization. For example, keeping personnel records current and pre-assigning personnel to specific mobilization slots can assure that IRR personnel can be located with a minimum of delay and that they will report promptly. Any improvement in the predicted 70 percent IRR show rate contributes to a reduction of the projected shortage. Nonetheless, the shortage is so great that under the most favorable circumstances, the total strength requirement cannot be met until the mid-1980s.

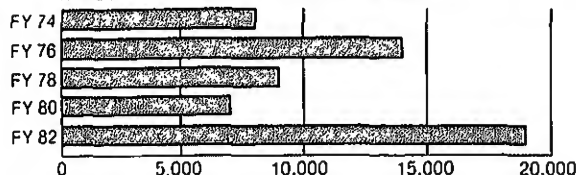
The Army also faces a severe shortage of health professionals in its Selected Reserve units. At the end of FY 1980, this shortage totalled 4,736 in the Army Reserve and 438 in the Army National Guard. This deficiency is particularly serious because the Army's ground forces are expected to sustain the largest number of casualties in the early days of combat.

The only encouraging note is that as many as 9,000 doctors may be in the Standby Reserve. How many are deployable is not known. DoD plans to

The greatest manpower problem facing the Department of Defense lies in rebuilding the pool of pretrained personnel that provides replacements in the early days of combat. While analysts disagree on the size of this shortfall for various reasons, it appears to be in the range of

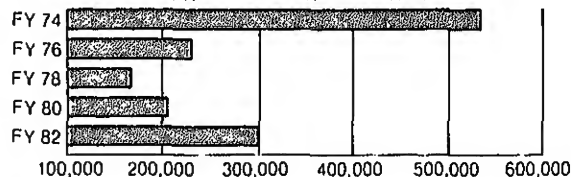


INACTIVE NATIONAL GUARD — ARMY

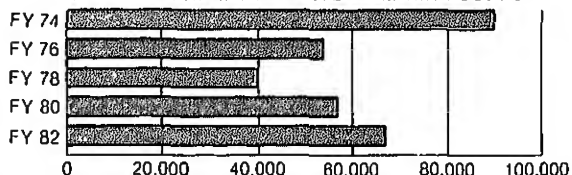


200,000 personnel. Since FY 1978, however, various management initiatives have resulted in an increase of about 75,000 individuals. Enlistment and reenlistment bonuses and tighter management controls are expected to further reduce the net shortage.

INDIVIDUAL READY RESERVE — ARMY



INDIVIDUAL READY RESERVE — MARINE CORPS



long-range program can place the required number of health professionals into unit assignments.

## Public support

Public understanding and support is the critical factor in achieving the strength goals of the Reserve forces. This is why DoD identified increasing public support for the Guard and Reserve as a major goal of its FY 1982 program.

An extensive program of DoD-supported research documents that the Reserve components as a whole will fail to reach required strength levels in the years ahead. Although recent public opinion polls show generally favorable attitudes toward the military, action must be taken to develop support and understanding for enlistment among groups which have traditionally exerted a negative influence. The research also confirms the importance of financial incentives and indicates that the educational assistance now offered should be not only cost-effective, but it should also be geared to higher-quality prospects. Incentives for affiliation or reenlistment with a Selected Reserve unit have

also are shown to exert an important effect on reenlistment decisions.

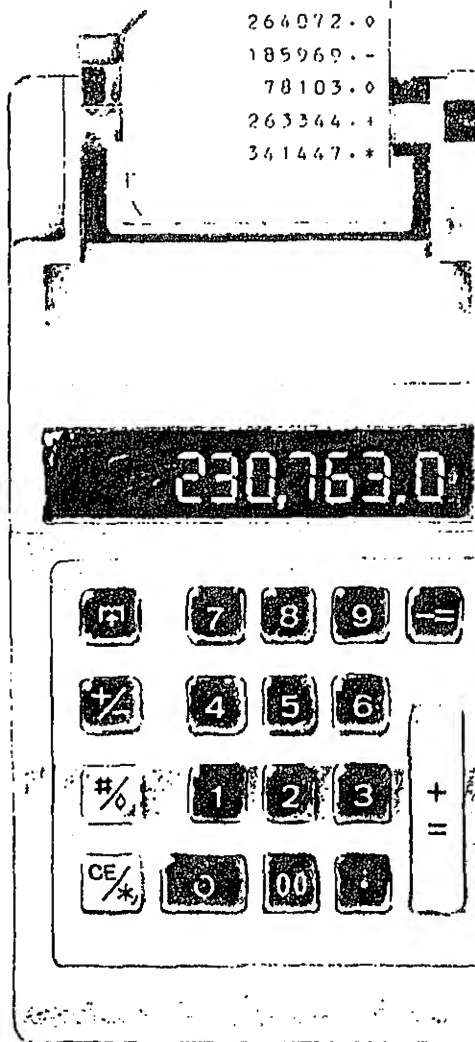
If the Reserve forces are to play a major part in deterring our potential adversaries, they will require the support of the general public. That support will be forthcoming if our defense planners can provide a realistic analysis and presentation of Reserve forces' needs, strengths, and shortcomings. An informed public understanding, combined with an appropriate investment and application of resources, can enable the Reserve components to achieve their required manpower levels and to fulfill their enhanced missions under the total-force policy. **DMJ**

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# OF THE AIR RESERVE

Active-force officers have questions and reservations concerning the capability and availability of the Air Reserve forces.

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appear respectable in the Eyes of our Friends and formidable to those who would otherwise become our enemies.<sup>1</sup>

—George Washington

**B**elief in the citizen-soldier dates to the earliest days of nationhood. Although the concept served our country well through World War II, the end of that war brought a new era. Technology ended the protection that geography had afforded the nation since the 1700s. To meet the unprecedented demands of the Cold War, America opted for a large standing peacetime military force. A major part of that standing force was a separate Air Force.

Ironically, even at a time when the nation was emphasizing air power, the Air National Guard and the Air Force Reserve entered a period when national strategy all but excluded them from a meaningful defense role. Air Reserve forces played only a follow-on role, augmenting an active force that was theoretically prepared to meet all immediate threats. Unfortunately, the Air Reserve forces were also poorly trained, supplied with obsolete equipment, and assigned no real mission. These factors contributed to the weekend warrior image that, to some extent, persists to this day.<sup>2</sup>

Active Air Force perceptions of Air Reserve forces are not just matters of academic interest. In the past decade, many factors, including economics, have spurred defense officials to integrate the Reserve components into the active-force structure. Under the total-force concept, millions of dollars have been spent to improve the equipment and training of the Air Reserve forces. And by almost every static measure of readiness, the Air National Guard and the Air Force Reserve possess significant combat capability. Yet, inaccurate

value of Reserve resources, those resources might be misallocated, to the detriment of the nation's defense.

This article examines survey responses of two groups of actual or prospective Air Force leaders about the readiness of the Air Reserve force. Career line officers who attended the Air War College or the Air Command and Staff College in the resident classes of 1980 were asked to agree or disagree with 11 survey items directly related to Reserve readiness. Each officer was asked to use any available information, including intuition.

Survey items related both to the capability and the availability of Air Reserve forces. The first five items measured perceptions of capability. This discussion examines the basis for each statement and analyzes Air War College and Air Command and Staff College perceptions of its validity.

### *Air Reserve capability*

The first survey item dealing with Air Reserve capability stated:

*Limited maintenance capability hinders the assignment of advanced aircraft to Air Reserve force units.*

This statement was developed from major Rand Corporation research reports completed in 1967<sup>3</sup> and 1977.<sup>4</sup> A person agreeing with this statement would probably do so because of concern that a part-time force cannot attain the proficiency required to maintain today's complex weapon systems. A person disagreeing might be aware of the work that full-time Air Reserve technicians do in support of Air Reserve force units and might also be aware that Reserve personnel frequently have prior active Air Force experience in their maintenance specialties that compensate somewhat for the part-time nature of Reserve participation. In

<sup>1</sup> As quoted in *Supplementary Military Forces: Reserves, Militias, Auxiliaries*, Louis A. Zurcher and Gwyn Harries-Jenkins, eds. (Beverly Hills: Sage Publications, 1978), p. 69.

<sup>2</sup> *Managing the Air Force*, Air War College, Department of Executive Management Studies, Maxwell AFB, Alabama, May 23, 1979, p. 458.

<sup>3</sup> G. H. Fisher, "The Air Reserve Forces Study, Volume II: A Discussion of Some Conceptual Issues," RM-5327-PR, The Rand Corporation, Santa Monica, California, July 1967.

<sup>4</sup> F. J. Morgan et al., "The Air Reserve Forces in the Total Force: Volume I, Overview and Analytical Approach," R-1977-1-1-AF, The Rand Corporation, Santa Monica, California, September 1977.

parably equipped active Air Force units.

Sixty-nine percent of the 387 respondents generally disagreed with this perception of Reserve maintenance capability (21 percent strongly disagreed and 48 percent disagreed), while 20 percent were neutral and 11 percent generally agreed.

The second item dealing with capability stated:

*All too often the Reserves have tended to be "social clubs" or a haven for retirement pay seekers, draft dodgers, and the like.*

This item, taken from the landmark 1967 Rand study of the Air Reserve forces, reflects a perception of the Reserves that developed in the years following World War II. The perception may have been strengthened as a result of President Johnson's decision to induct much of the manpower needed to augment the active military forces in Vietnam rather than mobilize the Reserve.

Nearly two-thirds of the respondents disagreed with this perception; almost a quarter of the responses were neutral.

The statutory purpose of the Reserve components is "to provide trained units and qualified persons available for active duty in the armed forces, in time of war or national emergency and at such other time as the national security requires."<sup>5</sup> The active Air Force, Air Force Reserve, and Air National Guard share responsibility for assuring this readiness. Whether the statement is true—and there is substantial evidence that it is true at least for the Selected Reserve—the following item was intended to measure respondents' perception of how well-prepared Reserve augmentation would be.

Almost three-quarters of the respondents agreed with the statements:

*Reservists are, for the most part, adequately trained to make a positive contribution from the first day of recall.*

Although only 14 percent strongly agreed, those who generally agreed outnumbered those who generally disagreed by a ratio of six to one.

Unlike other Reserve components, the Air Reserve forces have competed successfully in the no-draft environment. The Air National Guard

lect. In *Air Force Magazine*, Bonner Day attributed that success to aggressive, active Air Force support of the total-force policy; use of Reserve units for active-duty missions; work that is related to civilian occupations or is interesting in its own right; and Air Reserve technicians who provide day-to-day management and administrative continuity.<sup>6</sup> Although some technical specialties are critically manned, the Air Reserve forces as a whole are at or near peacetime strength ceilings.

The survey yielded different responses from the two schools concerning the statement:

*One of the key problems facing the Air Reserve forces today is undermanning of Reserve units.*

The Air War College respondents generally agreed with this perception, but Air Command and Staff College students were evenly split between general agreement and general disagreement; only 14 percent gave neutral responses. It is interesting to speculate on reasons for this difference. Since recruiting and retention have been important problems for the active force during the past two years, senior officers may have extrapolated that difficulty to the Reserves. In contrast, officers in the intermediate school are closer in age and rank to many of the separating personnel, and they may have friends who stayed in the Reserves.

The final item on capability stated:

*The Ready Reserve comprises manpower which could be useful primarily in a sustained conflict when a gradual build-up would occur since this would allow the time to train them for their specific assignments.*

This item was constructed by substituting Ready for Standby in a description of the Standby Reserve.<sup>7</sup> The Ready Reserve comprises manpower which receives the training "required to maintain combat effectiveness"<sup>8</sup> prior to the initiation of a

<sup>5</sup> Bonner Day, "Air Reserve Forces Face Increasing Difficulties," *Air Force Magazine*, August 1979, p. 82.

<sup>7</sup> Major David E. Heistand, "Utilization of Air Reserve Forces—Concepts of Management and Applications for the Future," research study prepared at the Air Command and Staff College, Air University, Maxwell AFB, Alabama, May 1969, p. 24.

<sup>8</sup> "Purpose, Policy, and Responsibilities for Air Reserve



who are obligated or who agree to report for active duty when called. Ready reservists are required to respond when they are called by the President or the Congress, or whenever authorized by law.<sup>9</sup>

The combined Air War College and Air Command and Staff College responses to this item were bimodal, with 43 percent generally agreeing and 38 percent generally disagreeing.

### *Air Reserve availability*

Air Reserve readiness also requires availability, which relates to the capacity of the Reserves to respond promptly. The first item related to availability stated:

*I am confident that most (90 percent) reservists will report for duty in response to a recall.*

This item was developed in response to a perception noted in the 1977 Rand report: "Past mobilizations have shown that Air Reserve force units will fail to mobilize a significant number of people, because many claim medical and-or hardship deferments." The item asked only for the respondent's personal opinion on the reliability of reservists during recall. The statement required no particular historical evidence to support the view.

In discussing their version of this perception,

tion.<sup>10</sup>

Although 72 percent of the survey respondents supported the statement, only one out of five of those agreeing indicated strong agreement, thus tending to dilute somewhat the significance of what appeared to be a large degree of support for the statement.

A second availability-related item measured the degree to which active Air Force officers believed a commercial pilot's occupation mobilization obligation would conflict during a recall. Derived from one of the "common perceptions" identified by the 1977 Rand study,<sup>11</sup> the item asserted:

*Rapid mobilization of commercial airline pilots who fill Reserve crew positions is questionable (e.g., at the same time a mobilization occurs, an airline may be required to meet its commitment to the MAC Civil Reserve Air Fleet).*

Rand researchers pointed out that, like other members of the Selected Reserve, Air Reserve pilots holding full-time jobs as commercial airline pilots must execute Ready Reserve service agreements. These agreements certify availability for active duty upon recall. Concerning a potential conflict with the Civil Reserve Air Fleet pilot needs, the Office of the Deputy Assistant Secretary

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**Ironically, even at a time when the nation was emphasizing air power, the Air National Guard and the Air Force Reserve entered a period when national strategy all but excluded them from a meaningful defense role.**

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Rand researchers observed that because of medical or hardship deferments both the Air National Guard and Air Force Reserve experienced dropout rates of approximately 20 percent during the Korean War and the Cuban and Berlin crises. As a result, the Reserves tightened entry and retention screening procedures. This action apparently had the desired result. During the limited Southeast Asia and Pueblo mobilizations of 1968, less than one percent of the 10,511 Air National Guard personnel recalled received medical or hardship dis-

of Defense (Reserve Affairs) reported in November 1979 that the ten top U.S. commercial air carriers employ approximately 29,000 pilots. Of those, less than 2.5 percent are Reserve pilots.<sup>12</sup>

The responses to this item indicated that almost half of the population believed that commercial airline pilots in Reserve crew positions are ques-

<sup>10</sup> F. J. Morgan et al., p. 18.

<sup>11</sup> Ibid., p. 19.

<sup>12</sup> Lt. Col. James L. Gould, "Reserve-Active Force Comparisons," USAF Office of the Deputy Assistant Secretary of

generally agreed with the statement. Almost one third of the officers indicated a neutral response.

The third item stated that:

*Legal constraints will probably delay the rapid mobilization of Air Reserve force units.*

The legal bases for mobilizing the Reserves are clear. Despite these laws, slightly fewer than half of the officers surveyed believed that legal constraints would not delay a rapid mobilization; more than a quarter of the respondents gave a neutral response. These answers appear to reflect a serious concern over how quickly active-duty forces can expect help from the reservists.

The ability of the Reserve components of all services to be readily absorbed by the active forces is a recurrent theme in official investigations of the Reserves and was the subject of one of the survey items:

*Reserve units are structured in a manner in which they may be rapidly integrated into the active force during a war or national crisis.*

In the past, the Air Reserve forces have scored well on this point. A 1975 Department of Defense report stated: "Air Reserve forces are ready to deploy earlier, are more thoroughly integrated into a single command structure, and operate equipment that is more modern than the Army or Navy Reserve components."<sup>13</sup> The General Accounting Office supported that position in a 1979 report. That report contained this finding:

*The Air Force gaining command concept and the Air Force Associate Program—in which Air Reserve units serve side-by-side with Active Military Airlift Command units in flying and maintaining Active Air Force equipment—have been particularly effective in integrating the Air Reserve components with the active force. These concepts have allowed the Air Force to develop a streamlined Air Reserve force command structure with a minimal number of command layers and overhead personnel.<sup>14</sup>*

Two-thirds of the surveyed officers generally

ability stated that:

*Political constraints will probably delay the rapid mobilization of Air Reserve force units.*

This statement reflects one of the commonly held perceptions of the Air Reserves identified in the 1977 Rand study. In the study, Rand noted that mobilizing Reserves has "significant national and international political consequences" that require consultations with the State Department, congressional leaders, and others. Historically, such a process has averaged two weeks. While consultations delay Reserve availability, the Rand report observed that "introduction of regular forces into hostilities or into an area of imminent hostilities is also preceded by extensive consultations."<sup>15</sup>

Whether mobilization would be delayed is conjectural. The survey item sought to determine whether decision makers perceive a delay in their use of reservists as they plan for mobilization and force deployment. Responses to the item produced a bimodal distribution, with more officers indicating agreement than disagreement—43 percent versus 36 percent. Air War College students felt more strongly that political constraints would delay rapid mobilization than did Air Command and Staff College students—60 percent to 43 percent. The responses to this and the previous survey item reflect serious concern about the timeliness of Reserve mobilization and employment.

The final survey item dealing with perceptions on Reserve availability stated:

*Specific congressional approval is required for the non-voluntary recall of reservists during peacetime.*

In fact, under certain circumstances the President may mobilize limited numbers of reservists under existing laws without recourse to additional congressional action. He may authorize a limited expansion if he determines that the situation requires not more than 100,000 Selected reservists

<sup>13</sup> The Guard and Reserve in the Total Force, Department of Defense, Washington, D.C., June 1975, p. 24.

<sup>14</sup> "Can the Army and Air Force Reserves Support the Active Forces Effectively?" General Accounting Office, report to the Congress, LCD 79-404 (Washington, D.C.: Government Printing Office, April 25, 1979), p. 125.

<sup>15</sup> F. J. Morgan et al., p. 22.

and the period of mobilization would not exceed 90 days. Or he may declare a national emergency which would enable him to mobilize up to one million members of the Ready Reserve for up to 24 months.

Of those responding to the item, 34 percent were neutral, 42 percent agreed with this perception, and 24 percent disagreed. Air War College respondents agreed with this item more often than did Air Command and Staff College officers—58 percent versus 38 percent. The Air Command and Staff College class was apparently better informed on this knowledge-based item.

Responses to the questionnaire suggest some general conclusions. The distributions of responses were similar for both senior officers and mid-career officers, and both officer groups showed substantial understanding and support of the Air Reserve forces. Yet, despite a generally positive attitude toward Reserve capability, a number of officers indicated a lukewarm acceptance of the total-force concept because of doubts about Reserve availability in a real contingency. Statistics indicate, and top-level defense leaders say, that the Air Reserve forces are ready. Nonetheless, the survey shows that many officers in the active force have questions and reservations about the availability and capability of the Reserves. **DMJ**

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## **The Reserve components of the United States**

The law establishes seven Reserve components in the armed forces of the United States:

- The Army National Guard of the United States
- The Army Reserve
- The Naval Reserve
- The Marine Corps Reserve
- The Air National Guard of the United States
- The Air Force Reserve
- The Coast Guard Reserve

The terms "Reserve components" or "Reserves" include the National Guard. In some situations, however, it is necessary to distinguish between guardsmen and reservists or Guard units and Reserve units, and the context usually makes it clear that a distinction is being made. Otherwise, "Reserve components" or "Reserves" should be considered all-inclusive.

## **DoD policy of Ready Reserve reporting in the event of mobilization**

The DoD policy is that, in a mobilization, all Ready reservists will report for active duty within 24 hours of notification to report, unless a different reporting time is specified by competent authority.

This policy requires all Ready reservists to report when so ordered. It allows no delays, deferrals, or exemptions, and no additional time between notification and reporting time. High school and college students will report. Personnel with five dependents will report. Personnel with important civilian jobs will report.

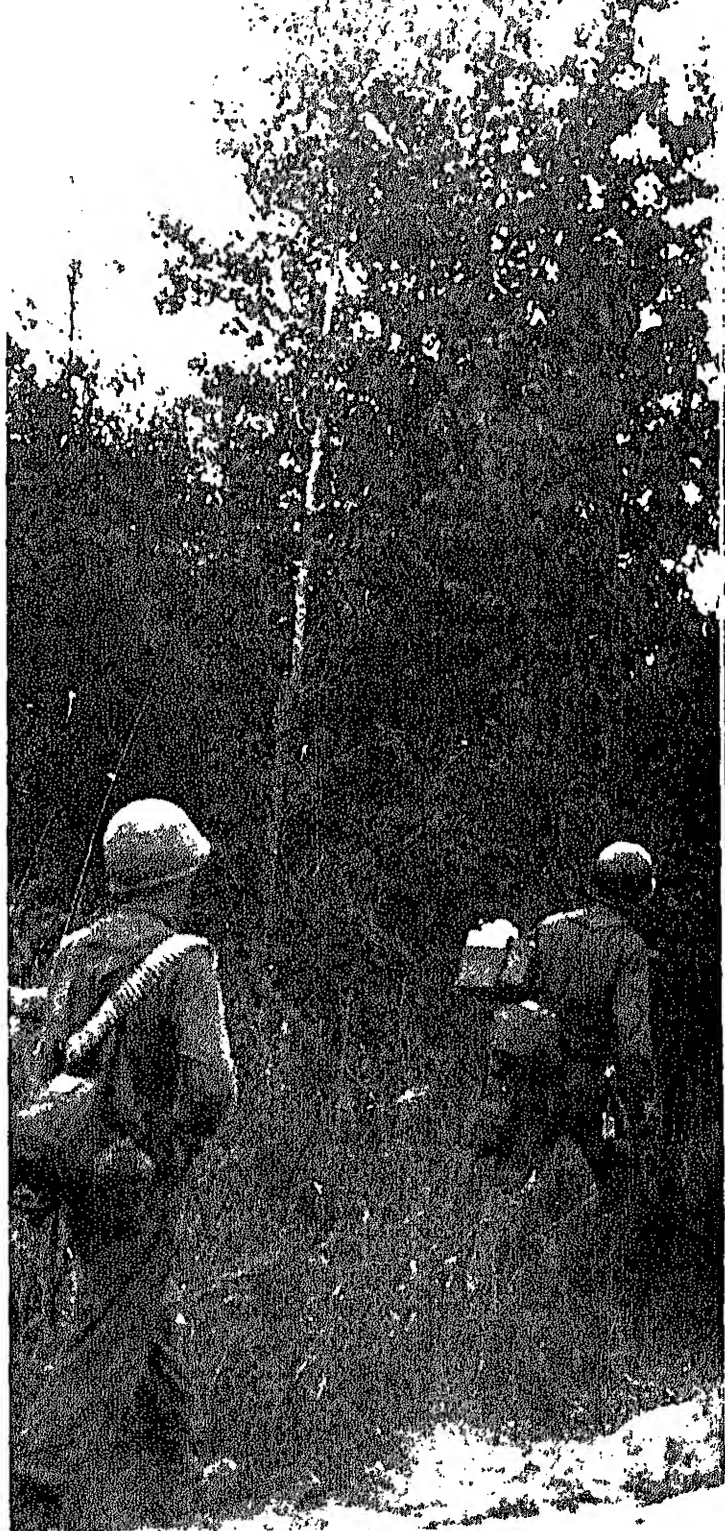
Members of the Ready Reserve must make advance arrangements to meet business, personal, or other responsibilities. If these arrangements are not made in advance, the personnel will report anyway.

All Ready Reservists must also be screened annually to determine their availability for mobilization. Those not available for mobilization are transferred out of the Ready Reserve, discharged, or retired, as appropriate. Ready reservists designated as key employees because they would be more important to national security in their civilian jobs than in their Reserve assignments are transferred to the Standby Reserve active-status list.

to participate in the earliest phases of any conflict. Reserve forces readiness can be defined as the ability to achieve the training needed to perform wartime missions, to mobilize and deploy, and to assist in defeating the enemy. The ability to mobilize effectively is dependent on such diverse factors as presidential or congressional disposition to order a mobilization, the general population's support for a mobilization, and the willingness of the individual guardsman or reservist to respond promptly to a mobilization directive. Over the last two decades, progress has been made in improving the Reserve forces' readiness capabilities, and in particular, their ability to mobilize.

Twenty years ago, the U.S. responded to the Soviet threat to West Berlin by increasing the size of conventional forces through a partial mobilization of nearly 150,000 guardsmen and reservists, by expanding the draft, and by involuntarily extending active-duty enlistment periods. In August 1961, Congress, at the President's request, provided authority for the mobilization of up to 250,000 reservists. Within three months two National Guard divisions and the Army Reserve's 100th Training Division were also mobilized. Those actions, coupled with other measures, permitted three active Army training divisions to be relieved of their training responsibilities and to prepare for their combat mission. By the end of 1961, these three divisions were declared combat ready. A few weeks later, the mobilized National Guard divisions completed their 13-week intensified combat training program. In the final analysis, it had taken about seven months to raise the number of combat-ready Army divisions from 11 to 16.

The Air Force mobilized 25 tactical Air Force squadrons and 6 transport squadrons of the Air National Guard in response to the Berlin crisis. Several tactical squadrons were deployed to Europe approximately six weeks after recall to active duty. The five troop carrier squadrons mobilized from the Air Force Reserve achieved operational capability within three months of recall. The Navy mobilized 8,000 reservists in the antisubmarine warfare field. Although no Marine Corps reservists



# Upgrading reserve readiness in the eighties

*Because readiness is so dependent on troops that are skilled in the use of their equipment and weapons, considerable attention is being devoted to improving Reserve forces training and training management.*





ere voluntarily recalled, significant numbers volunteered and were accepted for extended active duty when the Marine Corps' active-duty force was expanded to 190,000.

The 1961 mobilization marked the first time that guardsmen and reservists were mobilized to prevent a war rather than to wage a war. While this mobilization proved effective, the overall readiness of the Reserve components in 1961 was not entirely satisfactory and would be considered unacceptable in today's environment. In the 1960s, it took seven months to increase the number of combat-ready divisions. In the 1980s, DoD wants to have its principal combat units in-theater within the first 90 days.

As mentioned previously, the disposition of the President or the Congress to order a mobilization is significant. The 1961 mobilization of the Reserve components was delayed because President Kennedy had to seek legislative authority for the call-up. Today, President Reagan would not encounter such a delay. In 1976, Congress passed legislation authorizing the President to order to active duty 50,000 Selected reservists for no longer than 90 days, without declaring a national emergency. This legislation provided the flexibility to deal with contingencies requiring a measured military response where a declaration of national emergency might be premature or have undesirable international or domestic consequences. Congress provided further flexibility when it later increased to 100,000 the number of reservists the President can order to active duty without declaring a national emergency. Expanding the ceiling to 100,000 has the added benefit of permitting planners to include Guard and Reserve units in the Rapid Deployment Joint Task Force.

Today's international situation has necessitated abandoning the 30-day alert period of the 1960s. Reservists are informed in unambiguous terms not to rely on having 30 days from the time of mobilization alert until they report for duty. They are now advised that instant mobilization may be a military necessity and they may be required to report to their duty station on a 24-hour notice.

The current plan for many Reserve units is to arrive in Europe during the first 30 days of a conflict.





tional Guard and Air Force Reserve must be able to mobilize combat-ready units within 24 hours and deploy them within 72 hours.

Reserve-component readiness goals are largely determined by the threat of the Warsaw Pact. The Pact's ability to rapidly mobilize its forces and launch a no-warning or little-warning attack requires the National Guard and the Reserves to maintain a higher state of readiness than was demanded of most of the active-component units based in the United States in the 1960s. It is likely that a NATO-Warsaw Pact confrontation would reach a critical phase in the first 180 days.

Another important reason for stringent readiness demands being placed on Reserve forces stems from the total-force policy. At the outset of the Berlin crisis, the active Army had 11 divisions at an authorized strength of 870,000. Today's active Army has 16 divisions, an apparent increase of nearly 50 percent; however, its authorized strength is below 800,000. This 16-division force structure can go to war only by calling on Reserve-component combat units as well as combat-support and combat-service support elements.

The Affiliation Program was initiated in 1974 to prepare *Selected Reserve component units to meet this challenge*. Reserve-component units round out nine of the eleven CONUS- and Hawaii-based active-component divisions that currently do not have their full complement of units. A total of four brigades, eight separate battalions, and three company-size elements are an integral part of the nine divisions. The guardsmen and reservists assigned to these units must be prepared to deploy with the divisions. Affiliated units must be at a high state of readiness and prepared for early deployment to the combat theater.

An important measure of total readiness is the ability to satisfy wartime manpower needs. The end of the draft in 1972 led to severe shortages of manpower in Selected Reserve units. As a result, Army Reserve components were unable to enlist and retain sufficient numbers. These recruitment shortfalls necessitated setting Army Reserve-component recruitment levels at attainable figures that were considerably below peacetime force-

of mobilization. Among the Army Reserve headquarters designated for direct deployment to Europe to serve as command and control headquarters are the 103d COSCOM, the 310th COSCOM, and the 113th COSCOM.

Reserve are more than 100,000 below desired levels.

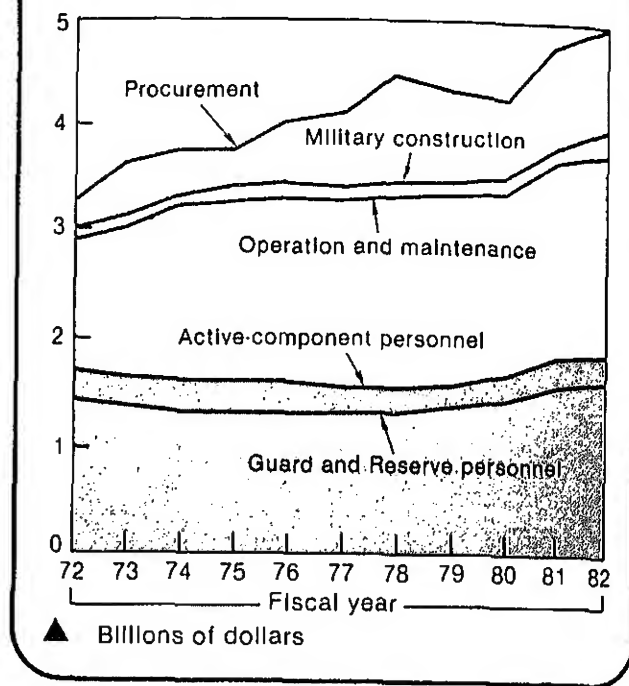
Incentives that are aimed at increasing Selected Reserve strength are an enlistment bonus of \$1,500 or an education incentive of up to \$4,000. Qualified individuals may receive reenlistment bonuses of up to \$1,800. In addition, there are enlistment options that permit an individual to serve as few as three years in a Selected Reserve unit, and a split-training option that permits those agreeing to serve six years in a Selected Reserve unit to complete their basic training and advanced individual training at separate times, rather than consecutively. Steps have been taken to increase advertising funds, secure additional full-time recruiters, and improve the management of the recruiting force.

A series of biennial mobilization exercises begun in 1976 have been instrumental in focusing attention on the critical shortages of pre-trained individual reservists. As the exercises identified manpower shortages in active units and in mobilized Guard and Reserve units, and as the computers highlighted casualty figures, the Army's Individual Ready Reserve was found to be woefully shy of the numbers of trained manpower needed. Accordingly, attrition management has gained increasing attention. Programs have been enacted to establish an inactive National Guard enlistment bonus and to employ cash bonuses of \$600 to unobligated members agreeing to a three-year reenlistment in the IRR. Additionally, the services may identify recent retirees, regular or Reserve, for voluntary or involuntary preassignment to appropriate wartime mobilization positions. These and other management actions are expected to bring the IRR up to desired levels by 1986. If they prove unsuccessful, the efficacy of a draft for the IRR may have to be addressed.

Readiness is dependent on well-trained troops that are skilled in the use of their equipment and weapons. On this account, considerable attention is being devoted to improving training and training management.

For example, Reserve planners are increasing the number of full-time support personnel assigned to the Reserves. Some full-time support personnel will

Estimated expenditures of the Guard and Reserve by major function or appropriation (in constant FY 1972 dollars)



uled training time. This will free the reservists for training. Other full-time support personnel will provide training assistance.

Emphasis is given to hands-on skill training with the equipment a guardsman or reservist will use at mobilization. Additional funds also are being allocated to field training exercises and command post exercises. Many Reserve-component units are performing their two-week active-duty deployment training outside the continental United States. Furthermore, an evaluation is being made of the advantages and disadvantages of expanding the two-week annual training period to three weeks for certain high-priority Army National Guard units. Guardsmen would be informed of the impending three-week tour one year in advance to minimize conflicts with civilian employers.

Although seeming somewhat contradictory, the changes in store for the National Guard and Ready Reserve in the '80s will be more of the same—but with a quantitative and qualitative edge. Programs

lense, the Office of Management and Budget, White House, and the Reserve community. A new approach during this decade will permit a realistic assessment of the personnel readiness of the Army Reserve components. By abandoning the previous policy of setting strengths at attainable goals, Reserve forces planners must go beyond peacetime force-structure thinking. Now the criterion for measuring personnel readiness will be the trained strength of a unit; personnel undergoing training will not be counted as trained strength of a unit. At mobilization, personnel will complete their training and probably will not deploy with their unit. For this reason, units should strive to exceed their wartime requirements by a figure equal to the number of *train-on-line* personnel assigned to the unit.

Similarly, a continuous screening of the Ready Reserve has been mandated to remove reservists whose civilian employment would preclude their mobilization. A rigid screening procedure is being applied to reservists employed full-time by the Federal government. Equally effective procedures must be used to screen reservists employed by state and local governments and private industry.

Short-term Reserve manpower improvements, beginning in FY 1982, include 17,724 Army Reserve component full-time support personnel, 800 National Guard manpower increases for direct Reserve units, and 380 full-time Marine Reserve support personnel.

Increased efforts will be made to increase public support for the National Guard and Ready Reserve through the Employer Support and Community Support Programs, and to foster a greater awareness of the importance of an adequately sized, trained, and equipped Reserve force.

One of the most difficult and least understood challenges facing the Guard and Reserves is reorganizing as new policies and plans are developed, and peacetime and war scenarios change. If outdated units are kept in the Reserve structure, new units cannot be organized.

Disconcertingly, such a retraining may represent a more effective and efficient combination of the personnel and equipment required to accomplish a mission.

Indicators of readiness such as insufficient funds for maintenance of equipment, spare-parts shortages, and inadequate supplies of training ammunition.

The increased dollar commitment to the Guard and Reserve is shown in the figure. A real growth rate of 3 percent is projected for Reserve-component appropriations for FY 1982. The proposed FY 1981 Supplemental and FY 1982 Amendment provide \$589 million for Reserve-component requirements during the two fiscal years—\$430 million for Army, \$57 million for the Navy and the Marine Corps, and \$102 million for the Air Force.

The most significant readiness-related increase is for equipment for early-deploying Army Guard and Reserve units. It includes supplies, clothing, and equipment funded from the Operation and Maintenance account and larger equipment items funded in the Army Procurement account; the request provides \$28 million in the FY 1981 Supplemental and \$307 million in the amended FY 1982 budget. These funds will reduce substantially the equipment deficiencies in the Operation and Maintenance accounts and provide for some of the priority requirements funded in the procurement accounts.

As long as we have neither the people nor the equipment to bring our Reserve units to full wartime capability, we cannot be fully ready. Faced with resource shortages, there is the great temptation to adjust readiness standards to make the Reserve components appear more ready than they are. Pro-Reserve rhetoric must be backed up by intensive efforts to improve and enhance the mobilization, deployment, and employment capability of our Reserve forces. **DMJ**

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# in the Selected Reserve

*Effective attrition management for the Reserve forces requires attention to a complex mix of factors that affect the participation decision.*



third year of six-year enlistments reached 60 percent. The Department of Defense's February 1981 report on Reserve attrition notes that, although Army Selected Reserve strength has improved considerably since 1976, "the loss of personnel prior to the end of the enlistment period continues to be a problem." Even in the face of significant improvements since 1978, the report states, "unprogrammed attrition is still too high."

Attrition and failed retention are vexing problems for military managers. Failure to retain trained individuals can cause critical manpower shortages, organizational turmoil, and reduced unit efficiency and morale. In terms of the return on training dollars spent, the premature loss of trained military personnel represents a waste of scarce financial resources.

Having recognized that "reduction of unprogrammed losses is the critical element in increasing Selected Reserve unit strength and readiness,"<sup>2</sup> DoD tasked LaBrie Associates with examining the factors which influence attrition and retention in the Army Reserve and Army National Guard. The results of that research, as reported in two studies—*The Concomitants of Attrition*<sup>3</sup> and *The Army Reserve and National Guard: A Study of Reenlisters and Dropouts*<sup>4</sup>—point to dissatisfaction with monetary and training benefits as major causes of attrition. But the research also revealed that extrinsic factors, most notably spouses' attitudes toward service in the Guard and Reserve, are likewise critical determinants of retention.

### *The concomitants of attrition*

The concomitants study focused on Army Reserve and Army Guard personnel from early-deploying combat support units who had no prior military service and who had not enlisted in order

recently in service and from individuals who left before completing their first term, was the first direct and systematic survey of unprogrammed losses.

Data collected from participants related to both intrinsic and extrinsic factors affecting attrition. The former, which have been the subject of most previous research, included factors such as military pay, training, and leadership, over which service managers and commanders have some control. Extrinsic factors, generally neglected by previous research, are those in a guardsman or reservist's civilian life which influence his or her ability and willingness to continue in the service. Chief among them are attitudes of spouse and employer and significant life events such as having a child, losing a job, or incurring major medical expenses.

The study sought not only to identify which intrinsic and extrinsic factors are major causes of attrition but also to determine how the interplay of the two might influence a guardsman or reservist's decision to separate from service. Using mailed questionnaires and follow-up peer interviews on a subsample of respondents, researchers gathered data from a sample of 448 individuals. Recipients of the questionnaires were first-term enlistees who entered the service after the draft had ended; approximately half were guardsmen and half reservists. Since responses from the two groups did not differ significantly on measures associated with attrition and retention, the results were combined for purposes of discussion. Also collected during the concomitants mail survey were responses from an additional 204 guardsmen who had enlisted before 1973 and later reenlisted. Researchers analyzed data supplied by these guardsmen as part of the follow-up study of reenlisters and dropouts.

Guardsmen and reservists surveyed belonged to one of three attrition-retention categories: unprogrammed losses, who did not complete their initial contractual obligation; non-reenlisters, who planned to complete their initial commitment but not to reenlist; and planned reenlisters, who planned to continue in another tour of duty. Using univariate analysis techniques, LaBrie Associates compared unprogrammed losses to planned reen-

<sup>1</sup> Report on Enlisted Attrition From Selected Reserve Units, Office of Deputy Assistant Secretary of Defense (Reserve Affairs), February 1981, pp. 5-6.

<sup>2</sup> Report on Enlisted Attrition, p. 6.

<sup>3</sup> The Concomitants of Attrition, LaBrie Associates, Cambridge, MA, submitted to OASD(MRA&L), June 1980.

<sup>4</sup> The Army Reserve and National Guard: A Study of Re-



the impact of combinations of factors on the decision to continue in the Selected Reserve. This procedure also served as an additional check and as an elaboration of the effort to discriminate between groups.

The analyses indicated that three factors most influence a guardsman's or reservist's decision to serve or discontinue service in the Selected Reserve: quality of training benefits, level of monetary incentives, and attitudes encountered in civilian life concerning Selected Reserve participation, especially the attitudes of spouse and employer.

Unprogrammed losses, non-reenlisters, and planned reenlisters all joined the Selected Reserve for essentially the same reasons: training and money. These two motives, cited by more than 70 percent of the respondents in each group, ranked far above others, such as affiliation, public service, and prestige. Respondents listed money and training as primary motives at least 30 percent more frequently than any other.

Of the three groups, planned reenlisters had more successful and rewarding military experiences. Approximately 95 percent received training in a military occupational specialty and 73 percent actually served in their specialty, compared to only 41 and 37 percent, respectively, among unprogrammed losses and non-reenlisters. Moreover, for equivalent periods of service, planned reenlisters attained at least half a grade higher than the other two groups.

In terms of their attitudes toward the Guard or Reserve, the three groups did differ but not as widely as might have been expected. For example, in terms of gripes about their units, those who had dropped out or were planning to do so at the end of their term of service differed from those planning to reenlist in only five of twenty instances. The actual or planned dropouts griped more only about pay (34 percent versus 17 percent), the quality and content of training (41 percent versus 13 percent, and 35 percent versus 10 percent, respectively), and the value of their military duties (33 percent versus 9 percent).

When asked for recommendations for improving the Guard or Reserve, the three groups basically agreed: again, they focused on money and training.

did differ, however, in the particular monetary and training recommendations they made. The actual or planned dropouts favored immediately realizable benefits, such as pay increases and improved quality of training. Those who planned to reenlist also favored these short-term improvements but called for more long-range benefits as well, including educational and retirement benefits and improved promotion opportunities.

In addition to looking at intrinsic causes of attrition such as dissatisfaction with money and training, the study also identified extrinsic factors and considered their influence on attrition in the Selected Reserves. One of these—spouse's attitude—was the single most important characteristic distinguishing actual or planned dropouts from those intending to reenlist. For the dropouts, that attitude was rarely positive and frequently negative, while for reenlisters, spouses' attitudes were just the reverse. Only 39 percent of the dropouts rated their spouses' attitudes positive, compared to 75 percent of the reenlisters; 27 percent of the dropouts, with the planned reenlisters, tended to confirm the findings of the concomitants study on study found that spouses' attitudes did not necessarily correlate with reservists' or guardsmen's gripes about the military, a finding which suggests that the spouse's attitude is in part an independent opinion which shapes decisions rather than simply reflecting them.

The study also found important differences among the three groups in employment, income, education, and certain personal characteristics. For example, only one out of five respondents among unprogrammed losses and non-reenlisters worked for a public employer, whereas one out of three planned reenlisters held a local, state, or federal government job. Such a finding suggests that public employers may be more supportive of the Guard and Reserves than their counterparts in the private sector.

Moreover, of the three groups, the unprogrammed losses were significantly more likely to be unemployed, have a low income, and be female. Almost half (46 percent) of the unprogrammed losses were unemployed, while only 11 percent held full-time jobs. Among respondents with low in-



questionnaire, 31 percent of the females and 14 percent of the males were unprogrammed losses.

Dropouts also cited personal problems most frequently—almost 38 percent of the time—as the reason for leaving the service; for non-reenlisters, the corresponding figure was only 12 percent. As noted earlier, responses to the questionnaire showed that actual and planned dropouts joined the Guard or Reserve for similar reasons and also had similar attitudes toward the Selected Reserve. Therefore, what these findings about personal characteristics and civilian lives suggest is that an unprogrammed loss is simply a non-reenlister whose problems in civilian life push him or her out of the service at an earlier stage.

### *Three attrition-retention scenarios*

The above differences between those who plan to reenlist and those who do not are fairly clear-cut. Three possible attrition-retention scenarios can serve both to summarize those differences and indicate how they may have evolved:

- Some guardsmen and reservists do not obtain as many benefits as others. Dissatisfied with rewards received, they tend to drop out. Results of the LaBrie survey support this scenario: actual and planned dropouts called for more improvements in immediate benefits; they also had significantly different military experiences than reenlisters in key areas such as training and service in military occupation specialty and pay grade for equivalent years of service.

- Some guardsmen and reservists may have higher or more pressing needs than can be met by serving in the Guard or Reserve. Considerable support exists for this scenario as well. Responses to the questionnaire showed that unprogrammed losses were more likely to be unemployed, that actual and planned dropouts had smaller family incomes, and that unprogrammed losses were more likely to have had a child or taken a part-time job within a year before separation from service. Perhaps most importantly, almost 40 percent of the unprogrammed losses cited personal problems as a reason for leaving. Some 30 percent of these in-

join. Therefore, they are more likely to be dissatisfied with the overall benefits of Selected Reserve participation because at least some of these, such as retirement benefits, are tied to longevity. Short-term commitments produce losses because the individuals never really intended to stay.

A critical element in all attrition-retention scenarios is the strong influence of the spouse and employer. The LaBrie study found that unprogrammed losses had the highest percentage of individuals who married after enlistment and the highest percentage of spouses and employers with negative attitudes toward Guard or Reserve participation. Moreover, the interviews with actual and planned dropouts revealed that one-third would change their mind about dropping out if their spouses' attitude were different.

### *A study of reenlisters and dropouts*

Data gathered on the 204 guardsmen who had enlisted prior to 1973 and subsequently reenlisted offered researchers an opportunity to corroborate and supplement the findings of the concomitants study. The planned reenlisters in the concomitants sample had indicated their *intention* to reenlist but had not yet actually done so. The 204 prior reenlisters had in fact taken that step and therefore, to the extent that they shared distinguishing characteristics with the planned reenlisters, tended to confirm the findings of the concomitants study on retention. Comparison of the two groups of reenlisters also promised to yield valuable information about changes taking place in the Selected Reserve as a result of changes in both societal factors and military policy.

The concomitants study revealed that unprogrammed losses and non-reenlisters—that is, those who drop out either before or after the end of their first term of service—are very similar in their reasons for joining, their gripes, their recommendations for improvement, and, with some exceptions, their personal characteristics. Therefore, in the follow-up *Study of Reenlisters and Dropouts*, researchers combined the two groups

In one respect, enlistment motives among prior reenlisters—those who had joined the Guard or Reserve before 1973—differed markedly from motives of guardsmen or reservists who enlisted after that date: 50 percent of the former group had joined to avoid the draft. Worth noting, however, is that, this motive aside, prior reenlisters joined for the same reasons as the other two groups: training and money. They listed those two reasons among their primary motives 60 and 45 percent of the time, respectively, while 75 percent of the dropouts and planned reenlisters cited the same as primary motives.

Other results of the study likewise reinforced the finding that dissatisfaction with money and training, or so-called earning and learning benefits, is a major cause of attrition. For example, both groups who enlisted after 1973—whether dropouts or planned reenlisters—griped more often about management and materiel than did the third group, who enlisted before 1973. Among the newer enlistees, 20 percent complained about the quality of officers and 30 to 40 percent about the age and amount of equipment, as opposed to 10 and approximately 15 percent, respectively, among the older group. However, as the figure shows, this alignment among the three groups did not hold true for complaints about pay and training. In those two categories, the views of planned and prior reenlisters more closely coincided and differed sharply from those of the dropouts.

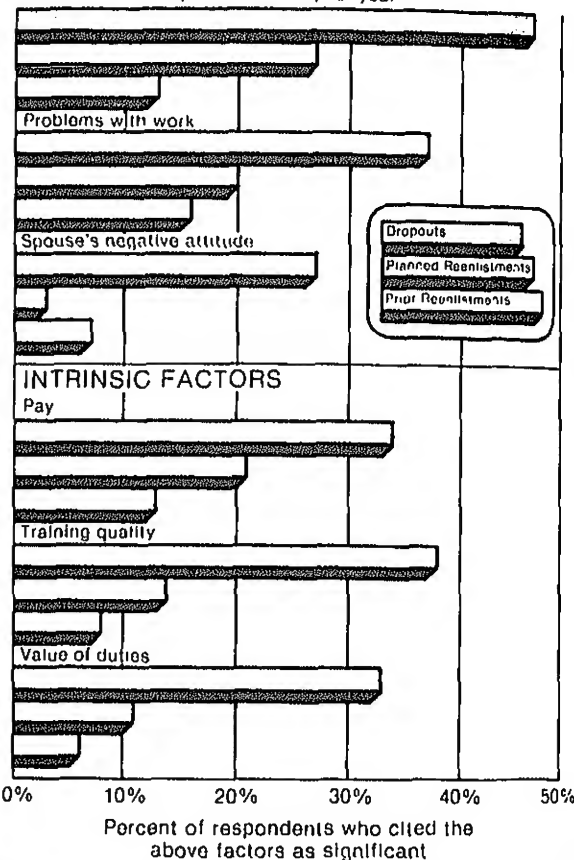
While the three groups were unanimous in favoring better pay and training, the prior and planned reenlisters, unlike the dropouts, also favored more long-range benefits. Bonuses, awards, and retirement benefits, for example, appealed to reenlisters two to three times more often than they did to dropouts. On the other hand, support for changes such as shorter enlistments and more help with personal problems was two to three times greater among dropouts.

As was the case in the concomitants study, researchers who did the *Study of Reenlisters and Dropouts* discovered that extrinsic factors have significant impact on attrition in the Selected Reserve.

Research from the *Study of Reenlisters and Dropouts* shows that reservists who fail to complete their terms of commitment are more likely to have experienced several disruptive events in their civilian lives in the previous 12 months and to have a spouse whose attitude about reserve duty is essentially negative than are those reservists who reenlist.

### EXTRINSIC FACTORS

Two or more disruptive events in past year



prior reenlisters. The data presented in the figure show that dropouts' spouses frequently had a negative attitude toward service in the Selected Reserve, while reenlisters only rarely reported such an attitude. These findings thus corroborate those of the concomitants study concerning the influence of spouses on attrition on retention in the Reserves.

Other extrinsic factors are influential as well. The data show that prior reenlisters have fewer disruptive events in their civilian lives than do

unprogrammed losses reported a much higher incidence of two or more disruptive events during the preceding year (66 percent) than did those who planned to honor their enlistment contract (37 percent).

Dropouts were also more likely to find that participation in the Selected Reserve infringed upon their civilian lives. Lost time from leisure activities such as vacations and time with family and friends was a problem for 65 percent of the dropouts, whereas fewer planned reenlisters (44 percent) and prior reenlisters (47 percent) had this problem. Likewise, dropouts more often reported various job conflicts due to participation in the Guard or Reserve.

Solutions to the problems identified in *The Concomitants of Attrition* and *A Study of Reenlisters and Dropouts* were beyond the scope of either study. However, the results of the two research efforts do suggest the broad outlines of an effective attrition management policy for the Army Selected Reserve. Better monetary benefits, both immediate and long-term, definitely deserve consideration as one element of the policy. Yet to be identified are the particular levels and combinations of pay, bonuses, and fringe benefits that will prove most cost-effective. Some measures to improve such benefits are already under way or under consideration as proposals. These include pay increases, the relatively new enlistment and reenlistment bonuses, and educational loan forgiveness and assistance programs, though the precise impact of these remains to be determined.

The quality and content of Selected Reserve training clearly has a major impact on attrition and retention and likewise merits attention. Better training is partly a function of money for items such as facilities, equipment, and transportation, but it is also a function of imaginative and thoughtful leadership. The Army's new battalion training management system, designed to make better trainers out of unit-level noncommissioned officers and officers, could have an important effect in improving the caliber of leadership.

Significant events in the civilian lives of many young guardsmen and reservists also influence

programs is a promising beginning. The programs themselves stress the need for unit commanders and noncommissioned officers, as well as managers at other levels, to be more aware of attrition-related issues and more active in dealing with them. Actions needed include quicker and more careful follow-up on unsatisfactory attendance and a greater willingness to help junior enlisted personnel with those problems in their civilian lives that can eventually lead to unprogrammed losses. Such efforts, especially when they reach out to the spouse and employer, could also help reduce attrition.

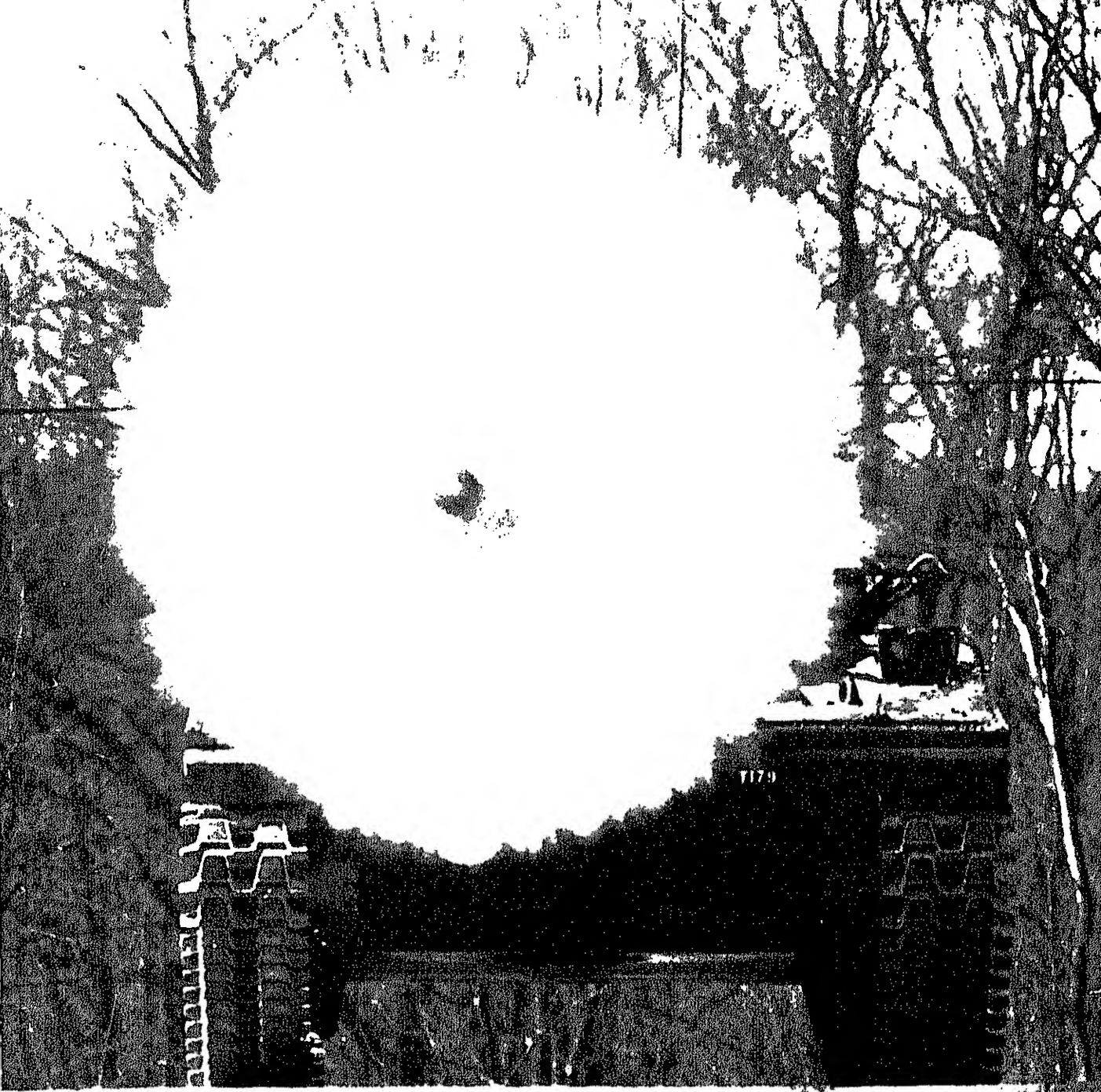
Combatting attrition requires attention to a complex mix of real and perceived needs and expectations, costs and benefits, and intrinsic and extrinsic influences. Dealing successfully with the multifaceted problem of attrition will require a diversity of programs and policies, including those mentioned above, others not cited, and still others currently being planned and developed by DoD and the services. The variety of current and future resources being devoted to this effort testifies to a major commitment to reduce attrition and promote retention. **DMJ**

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By CAPTAIN P. E. SMITH, USN

## Challenge of the eighties:

*Providing the Reserve forces with equipment that is identical to that furnished the active forces ensures effective combat integration of the Reserve components with their active-force counterparts.*

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Equipping the Reserves has long been a matter of concern in the Department of Defense. In 1947, for example, the first Secretary of Defense, James Forrestal, established a committee known as the Gray Board to undertake "a brutally realistic consideration of what Reserve units, or persons drawn from Reserve units, would in fact be able to do at the outbreak of a war," and subsequently, to give "due regard to probable state of training, possible state of equipment, and time factors in mobilization."<sup>1</sup>

The Gray Board discovered that during World War II nearly three years had elapsed before we were able to equip the Reserves for offensive operations, although troops to use the equipment were available at an earlier date. Not unexpectedly, the Gray Board concluded that "initial issues of necessary equipment should be speeded up." To better equip the Reserve forces, the Gray Board's final report recommended that:

- "as the present status of supplies and equipment is inadequate for planned or required strengths, additional procurement should be initiated . . . , (and)

- the Supply and Equipment program for the Reserve forces should be made more realistic and adapted to their mobilization status, their training, and the facilities available."<sup>2</sup>

Shortly thereafter, the Department of Defense set a "get well" date for National Guard and Reserve units—a date when the units would have sufficient combat-serviceable equipment to "go to war." Unfortunately, that "get well" date and subsequent "get well" dates were generally in the out-years of the budget. Furthermore, whenever DoD seemed to make progress in improving the

Reserve forces' equipment posture, there seemed to be setbacks as well, often because an unprogrammed higher priority intervened. For over three decades, there have been "ailing" Guard and Reserve units, as equipment "get well" dates have edged ever forward.

Unfortunately, problems in equipping the Reserve forces are not a post-World War II phenomenon. There are numerous historic precedents. When the regulars carried the breech-loading Springfield rifle, for example, their counterparts in the militia made do with the percussion-ignition musket. During the Spanish-American War, the regular Army fought with Krag-Jorgensen rifles, equipped with 5-round box magazine and smokeless cartridges, while the mobilized National Guard troops had to rely on the single-shot, black-powdered Springfield. During a major mobilization exercise in the 1920s, the Reserve forces were greatly dependent on horses and mules, and even these animals represented an "aging equipment" problem, since many had been purchased during World War I. More recently, mobilization exercises found the Air Force Reserve flying piston-powered C-123 and C-7 aircraft.

As DoD attempts to formulate coherent and rational programs for effectively equipping the Guard and Reserves in the 1980s, it is important to recognize the inadequacy of measuring one year's equipment status against another. The correct measurement is made by observing and evaluating the quality and quantity of equipment in the hands of a potential aggressor: as it receives state-of-the-art weaponry with increased range, accuracy, reliability, and killing power, it is incumbent on defense planners to ensure that U.S. forces also are provided with improved weapons.

Five years ago it was popular to say that the

<sup>1</sup> Memo November 20, 1947, from the Secretary of Defense to the Assistant Secretary of the Army (reproduced in Reserve

and deployed in a future crisis. In other words, a unit could be committed to battle with less than 100 percent of its personnel and equipment, and as a result, its staying power in combat could be severely limited. At best, it would be risky to consider deploying a unit that did not meet at least minimal combat readiness; at worst, it would certainly place an additional burden on the theater commander receiving the unready unit.

The "come as you are" philosophy was never intended to justify equipment shortages in the Reserve forces. Rather, it was meant to convey the importance of restoring Reserve units to a high state of peacetime readiness. The intended definition of "come as you are" can be seen in a statement by General David C. Jones, Chairman of the Joint Chiefs of Staff: "We must view readiness . . . through bifocals—attentive to long-term fixes but concentrating on maximizing our capacity to fight with what we have today." One of the long-term fixes implicit under the total-force concept is to provide the Reserve forces with equipment that would enable them to complement and fight alongside regular U.S. forces in the earliest stages of any conflict.

These fixes are already under way. Air Force modernization initiatives for the Air National Guard and the Air Force Reserve include introduction of the A-10 Thunderbolt II and increases in F-106 Delta Darts. Some units will convert from C-130A to C-130E aircraft, while others will convert from C-130E to C-130H. As obsolescent equipment is phased out of the Air Guard and Reserve, it will be replaced with new systems superior to or competitive with the best Soviet products.

Modernization initiatives within the Naval Reserve include delivery of additional C-9B aircraft to provide partial relief for the retiring C-118s and a program to modernize the antisubmarine warfare capabilities of the Naval Reserve's P-3 patrol aircraft. In addition, the Navy plans to retire older Naval Reserve FRAM I destroyers. Eight FRAMS will remain in use during FY 1981; in FY 1982, the four remaining will be replaced with four FF-1052 class frigates. Additionally, the Navy is in the process of developing plans to fur-

area is to improve the quantity of the equipment available to our Reserve ground forces. The seriousness of the equipment shortages that plague the ground forces was vividly illustrated when the Marine Corps commandant proposed a reduction

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*For over three decades, there have been "ailing" Guard and Reserve units, as equipment "get well" dates have edged ever forward.*

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in the active-troop strength as a solution to obtaining funds to equip the remaining force. In calling for increased buys of weapons and equipment for the Army, Secretary Marsh has noted that:

*"Many of our Reserve component units have significant shortages in essential types of equipment or are armed with older, less capable weapons. As we move to equip our Army with modern systems, we cannot forget that our Reserve soldiers, once mobilized and deployed, also must be prepared to face an enemy with modern, sophisticated weapons."*

### *Commonality of equipment*

The advantages of providing the Reserve forces with equipment identical to that furnished the active forces are obvious: commonality facilitates training of personnel, simplifies maintenance, maximizes utilization of equipment, and ensures effective combat integration of the Reserve forces with the active forces.

Reserve units did not need their full allotment of equipment in an era when Reserve force planning envisioned several months elapsing from the time of mobilization to the time of commitment to combat. Reserve units simply required sufficient equipment for realistic training. However, today's Reserve forces are expected to deploy in days, not months. This means that early-deploying units re-



the problem of equipping the Reserve open to a reasonably prompt solution. At the end of FY 1973, combat-capable equipment on hand for the Army National Guard and Army Reserve totalled approximately 50 percent or about half of the mobilization requirement. Today, the Army Reserve components are still short of equipment, but the requirement levels have increased to 100 percent. Despite the increased value of the equipment, Reserve components still have only 50 percent of the mobilization requirement. While rationing policies and equipment redistribution will help alleviate Reserve-component needs, Reserve forces planners also must consider the procurement of the additional equipment to achieve the readiness requirements of the total-force policy.

Another problem associated with equipment is the spare-parts shortage. Spare-parts shortages plague both the active and the Reserve components. The commander who discusses operational requirements undoubtedly relates a particular shortcoming: a major piece of equipment that is short of a part that costs only a few

dollars. Usually, some budget planners do not fully appreciate the importance of spare parts for all readiness. When underprocurement of spare parts becomes an established policy because of dollar constraints, the supply system is in trouble. Disconcertingly, this often translates into a long or longer waiting period to get a complicated part off the production

line. Shortages can also contribute to the cannibalization of any deadlined piece of equipment. Once the cannibalization process begins on a piece of equipment, that equipment becomes what is known in runway slang as a "cannibal queen"—a plane that is never repaired because it is continually stripped of parts from other planes in the air. The most vulnerable weapon system in the world is of no use if it is out of commission due to a spare-parts

problem. If any increase in readiness is to be expected.

Concurrently, life-cycle management of equipment must be improved. Maintenance concepts and policies must adhere to the total-force policy; a particular type of equipment cannot be forgotten just because it is found exclusively in the National Guard or an element of the Reserves. If an item is in the Army Guard or Reserve, it should be viewed as being in the Army inventory, with the appropriate operator training and mechanical maintenance training provided. Manuals and spare parts also must be kept current and made available.

The cost of a jeep, a hand grenade, an M-16, or a bullet for an M-16 has tripled in the last decade. Nonetheless, this nation really has little choice in affording what is necessary for national security. Neither Congress nor the public will permit Warsaw Pact modernization to constantly outpace NATO modernization. In order to develop policies that are responsive to lessons learned and appropriate to the perceived challenges of the 1980s, the combat capabilities of our Reserve forces must not be constrained by programmed equipment deficiencies. Planning efforts must be geared to bring all Guard and Reserve units to the state of equipment readiness necessary to meet planned deployment schedules. **DMJ**

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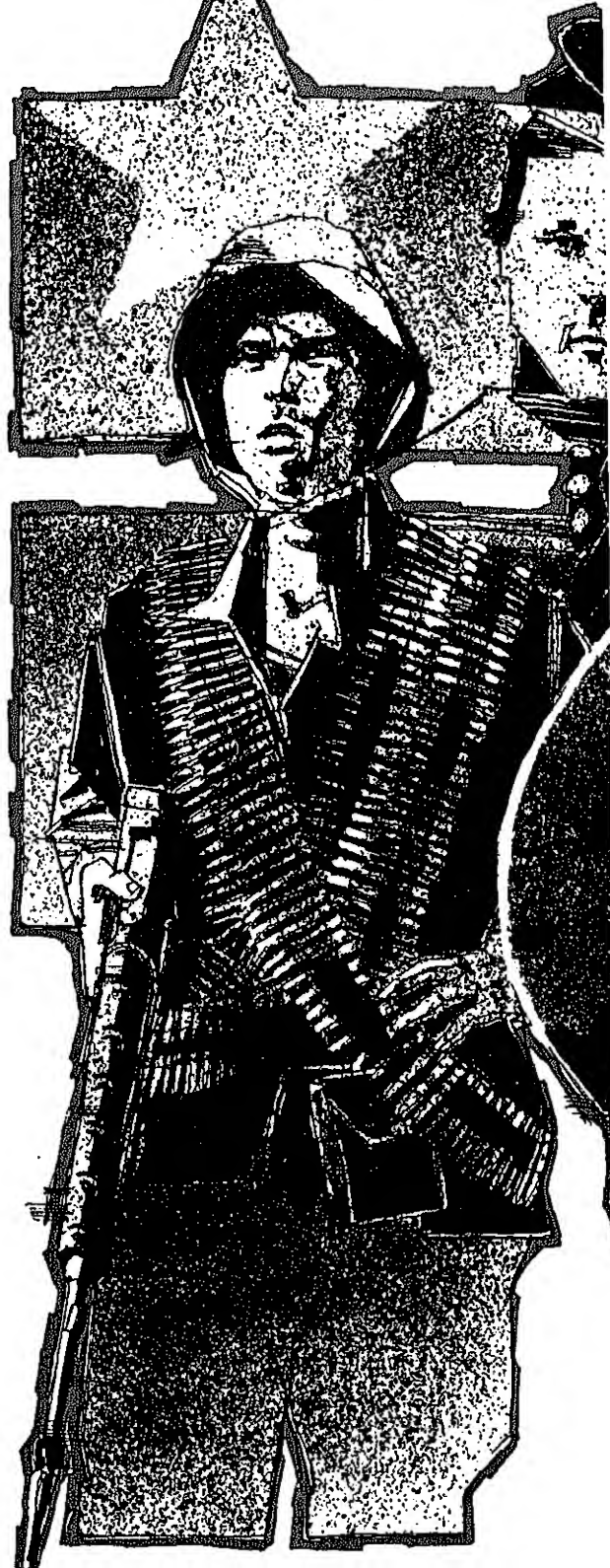
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# Pay and the Army Selected Reserve reenlistment decision

*Benefits and less tangible but very influential factors such as employer and family support are critical to a successful Selected Reserve manpower policy.*

**F**ollowing termination of the draft in January 1973, the number of enlisted personnel in the Army Selected Reserve components (the Army Reserve and Army National Guard) declined for four successive years. Reserve ranks, which stood at 638,000 in June 1973, numbered only 527,000 in September 1978. This decline raised serious concerns about the viability of the Army Selected Reserve in an all-volunteer environment. Failure of the Selected Reserves to meet strength goals could endanger the entire all-volunteer force concept. Under the total-force policy, the success of the AVF depends upon a strong Reserve force supporting a smaller and less rapidly expandable active force. The Reserve strength situation, in fact, triggered some congressional recommendations to return to a draft.

Such drastic solutions were put forward at the time because the decline was not understood and therefore policies that could be counted on to reverse the trend were largely a matter for conjecture. This article will describe the results of research which has helped us understand why the decline took place and what policies are likely to





experiment, researchers collected data from individual reservists who were deciding whether to reenlist. Thus, in addition to evaluating the effectiveness of a reenlistment bonus, researchers were able to investigate hypotheses concerning reservists' motivation for staying and leaving.

The primary focus of the research was the influence of Reserve pay on reenlistment decisions. If reservists were highly responsive to better pay, then policymakers could target monetary incentives as the primary means for rebuilding Reserve strength. A weak response, however, suggests the advisability of searching for less expensive solutions before making a commitment to increased pay.

In fact, results indicated that Reserve pay increases have much less effect on retention than assumed during the planning of the all-volunteer force. Since increased pay was the primary policy initiative in moving to an AVF, this finding could account for part of the significant decline in manning of the Army National Guard and Army Reserve after the end of the draft. Stabilizing Reserve strength in the all-volunteer force would have required a much larger pay raise for the Reserves.

We also found that the decision to participate in the Reserves depends on many other factors besides pay, and some of these also have more influence on the decision to reenlist than does money. Promotion opportunity, family circumstances, and the nature of the reservist's civilian job are some of these other factors. Thus in shaping Reserve personnel policies, certain nonpay options also deserve prominence.

### *Manning the Reserves*

Manning the Selected Reserves was relatively easy during the draft era. Individuals holding low lottery numbers were under draft pressure, and many entered the Reserves to avoid active duty service. Reserve units even had queues of people waiting to join. When the draft ended, Reserve units had to compete in the local civilian labor market for sufficient volunteers to maintain strength. For many units, the local labor market

deterioration in the readiness of the Army Selected Reserve components. That readiness depends not only on overall strength levels, but also on the specific strength levels of particular units. Manpower shortages in early deploying units, for example, are more serious than shortages in later deploying units. And, unlike the active forces, the Selected Reserves cannot minimize the impact of localized shortages by reassigning individuals from low- to high-priority units. The Reserves must fill each unit by recruiting in the local labor market. In terms of personnel readiness, the Reserves are thus unusually vulnerable. If all units are 20 percent short of personnel, for example, no unit is classified as ready.

Though Army Selected Reserve strength declined during the early AVF period, manpower levels remained relatively stable in the active Army. The end of the draft did not affect the active Army and Army Reserve components in the same way. The Gates Commission, which planned the transition to an AVF, had assumed that raising entry-level pay for both active and Reserve forces would attract enough volunteers to replace draftees and draft-motivated enlistees. Research conducted in the 1960s led the commission to conclude that pay raises for the active forces would be effective in increasing both enlistments and reenlistments. But little research was available to support similar conclusions for the Reserve forces, and the Gates Commission thus cautioned:

*"Analysis of the Reserve problem, however, suffers seriously from a lack of data. Even though special care was taken to provide against error of estimation, the assessments of what is required to maintain an All-Volunteer Force are much more tenuous than for the Active Force. . . . Given the uncertainty which surrounds projections of Reserve enlistments and losses, further steps beyond the recommended pay increase may be necessary. Any further steps should await the results of experience with higher pay during the first few years."\**

If the Gates Commission assumptions concerning pay had been accurate, both active and Reserve

Army strength levels, since youth have least preference for the Army, while it has the greatest demand for manpower. In the active Army, the 1971 and 1972 pay increases did have close to the predicted effect on accessions, and thus enlisted strength did not decline. Reserve strength may have declined because the pay increases had a smaller-than-predicted effect on enlistments; unfortunately, the effect could not be measured for the Reserves due to the quality of existing data. The FY 1978 defense appropriations bill, however, did fund a \$5 million test of the reenlistment bonus for the Reserves and therefore did afford another opportunity to test the responsiveness of guardsmen and reservists to monetary incentives.

Within the Department of Defense, the Assistant Secretary of Defense (Manpower, Reserve Affairs and Logistics) had responsibility for the test. He maintained control over the design, monitoring, and evaluation of the test and over draft administration guidelines for the Army National Guard and Army Reserve. OASD(MRA&L) asked Rand to participate in the test design, monitoring, and evaluation stages.

## Test Design

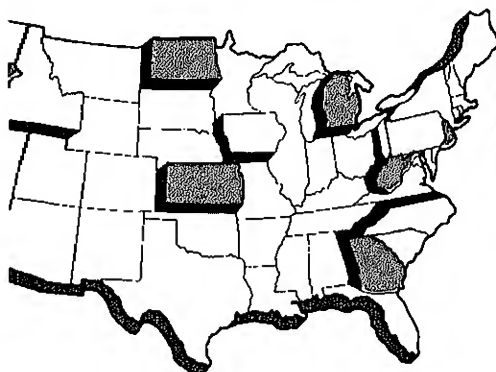
The Army Reserve and the Army National Guard received \$2 million and \$3 million, respectively, to conduct the reenlistment test. They paid bonuses for three-year (\$900) and six-year (\$1,800) reenlistments—one-half the bonus amount at the time of reenlistment and the remainder in \$150 installments at the completion of each satisfactory year of service during the term. The objectives of the bonus program were to increase reenlistment rates and to lengthen reservists' term of commitment. Before the bonus test, most reservists who did not separate extended their term for a single year. This policy of allowing one-year extensions probably increased retention in the short run by

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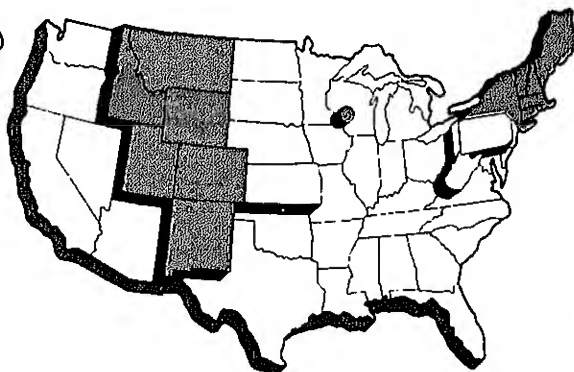
\*The Report of the President's Commission on an All-Volunteer Force (Washington, D.C.: Government Printing Office, 1970), p. 97.

were offered, researchers chose a corresponding state or region, similar in past retention behavior and economic characteristics, where bonuses were not offered.

## Army National Guard



## Army Reserve



## Bonus

Control

term commitments, with all their attendant liabilities, unnecessary. However, this growth came at the expense of force and resulted in turbulence later.

by Congress, bonus payments were made to reservists with less than eight years of service. These reservists were either encouraged to reenlist for the first time or called up for a second or third term. They faced a critical career juncture in terms of reenlistment. Among reservists with eight or more years of service, retention rate begins to increase sharply, probably due to the attractiveness of reenlistment benefits. Congress further reduced the bonus payment to reservists who had no previous force experience.

ly measure the effect of the bonus on reenlistment rates and on the level of commitment, researchers made available to part of the eligible Reserve (treatment population) but withheld them from the other part (control population). Comparing reenlistment rates and length of terms, researchers found no significant differences in the two

Approximately 15,000 guardsmen and reservists took part in the test and control states and regions (see Figure 1). All the participants reached the end of their term of service in 1978. Researchers monitored the reenlistment decisions of all 15,000 and asked certain individuals in both test and control regions to complete a questionnaire at the time of their decision.

Later, researchers did two separate analyses on data collected during the experiment. In the first, more narrowly focused analysis, they simply compared behavior between test and control groups in order to determine the effect of the bonus on reenlistment rates, choice of term of service, and subsequent attrition behavior. The purpose of the second analysis was to differentiate characteristics of those who separated from the characteristics of those who stayed. Researchers used survey data on type of civilian job, rate of pay for civilian jobs, hours of work, employer characteristics, personal and family characteristics, military history, and reserve pay.

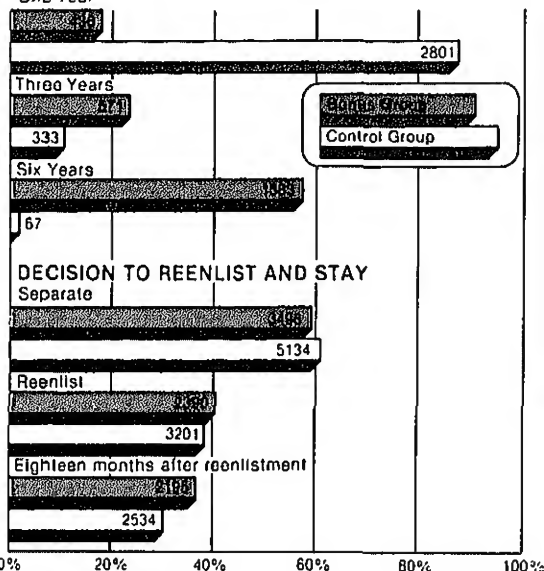
The four sections that follow present the results of these analyses. The first summarizes the effects

## reservists' reenlistment rates and terms of commitment

In an experimental program, bonuses of \$900 and \$1,800 for 3- and 6-year reenlistments, respectively, were offered to almost 6,000 guardsmen and reservists. While such bonuses did not significantly affect reenlistment rates, they clearly encouraged longer terms of commitment from those reservists who did reenlist.

### TERM OF COMMITMENT

One Year



reenlistment rates. The third section discusses the effect of the family and employer on Reserve retention. Finally, we consider some other factors that affect retention.

### Effects of the bonus

Bonus payments offered in the experiment had a small, but statistically significant effect on reenlistment rates. Although the bonuses boosted reservists' income by more than 30 percent, they resulted in an increase of only 2.2 percentage points in reenlistment rates—from 38.4 to 40.6 percent. However, the bonus definitely encouraged longer terms of commitment (see Figure 2). Among reservists who reenlisted, 82 percent of those in test regions selected 3- or 6-year terms, while only 12 percent of those in control regions did so. The average term of

Those who reenlist for only one year, for example, may continue to reenlist for one year at a time, and those who reenlist for three or six years may leave before completing their commitment. To find out whether longer terms of commitment actually resulted in additional manyears, researchers did a follow-up on test and control groups 1½ years after their initial decision.

The difference in behavior between the two groups was significant. Of those who were in the original sample, 37.3 percent of the test group were still present 1½ years later, compared to only 30.4 percent of the control group. Providing incentives to choose longer terms resulted in higher strength levels. Given an annual choice to reenlist or separate, many reservists left, perhaps swayed by new situations in their civilian work lives or family lives. Incentives apparently helped those who made longer commitments honor those commitments despite any new situations in their personal lives.

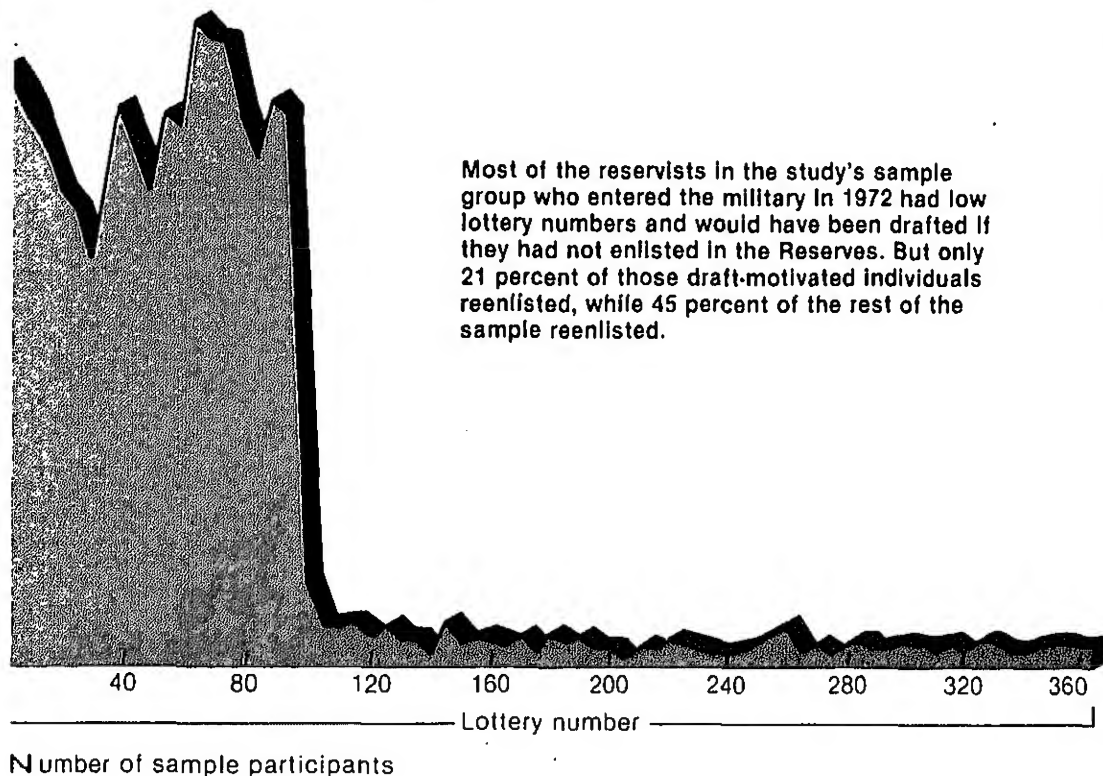
Longer terms of commitment have other benefits for the Reserve as well. They result in lower administrative costs associated with record keeping and retention counseling, and longer commitments may improve the credibility and reliability of Reserve units in mobilization situations. Longer terms of commitment among reservists also decrease the opportunity to separate during pre-mobilization phases of international crises and thus may improve readiness.

Despite the incentive of bonuses, 62 percent of the reservists in our total sample separated from the Guard or Reserve at the end of their first term of service. One reason for this high separation rate was the presence of men who entered the Reserves under draft pressure. Most guardsmen and reservists in our sample who entered in 1972, the last year of the draft, had low lottery numbers (see Figure 3) and would have been drafted had they not entered the Reserves. Not unexpectedly, the reenlistment rate for these individuals was significantly lower than for first-term, nondraft-motivated individuals in the sample. Only 22 percent among the former group reenlisted, compared to 42 percent among the latter.

These reenlistment rates help explain the decline



Figure 3. The effect of the draft on the Reserves



There was apparently a temporary transition associated with the large number of draft-motivated individuals remaining in the Army Reserve component after the end of the Vietnam War. These draft-motivated personnel depressed reenlistment rates; as a result, losses at first-term expiration were high. Through 1978, the last year first-term, draft-motivated youths were still present in the Reserves. In 1978, individuals making first-term reenlistment decisions were all volunteers, who reenlist at higher rates. Reserve strength should rise sharply. In fact, the downward trend in Selected Reserve component manning did

reverse in 1979 (see Figure 4 on p. 56), though the influx of draft-motivated youth can explain only part of this reversal, since the Reserves realized a major gain in strength in 1980. The 1980 increase probably reflects the effectiveness of accession

incentives. Selected Reserves now have enlistment bonuses and expanded educational incentives.

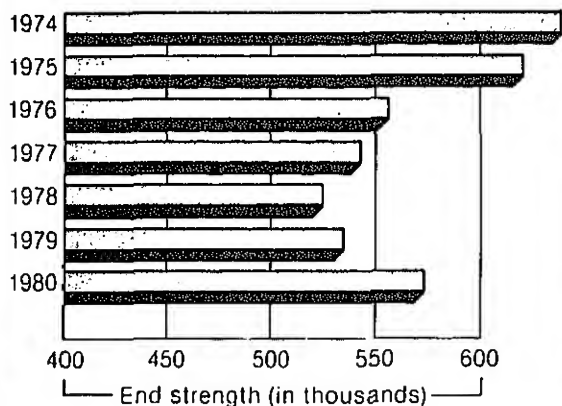
### *The effect of Reserve pay*

A reenlistment bonus is not the equivalent of an increase in pay. A bonus is paid over a single term, and an individual must choose a longer term of service to qualify for it. Thus, although we found a fairly small rise in reenlistment rates in response to a sizable bonus, we cannot extrapolate this effect to an increase in Reserve pay. But by using survey data relating to Reserve income, we can project the effect that Reserve pay increases might have.

The level of Reserve pay does little to encourage reenlistment in the Army Selected Reserve components. Whereas the Gates Commission assumed that a 10-percent increase in Reserve pay would result in an 8-percent increase in first-term re-

## all-volunteer force

The downward trend in strength of Army Selected Reserve components changed in 1979 due to both the absence of draft-motivated youth and the effectiveness of accession and retention programs.



▲ Fiscal Year

be more likely. The net, after-tax income actually derived from Reserve pay is much smaller than commonly perceived and thus less effective as an incentive to reenlist.

The difference between gross Reserve pay and net, after-tax Reserve earnings is significant. In 1978, the average reservist in our sample who attended summer camp and 48 drills received \$1400 in gross Reserve pay. However, two types of costs reduced the reservist's net earnings on this amount—transportation to and from drills and income lost from civilian jobs while attending annual training. The average reservist in our sample commuted 21 miles, each way, to Reserve drills and a majority of them lost income as a result of attending annual training. They would have made more money by working their civilian jobs than they did by participating in Reserve training. Reservists who lost the most had higher civilian incomes and an employer whose summer camp policy provided no civilian income. For personnel in our sample, the average income loss due to commuting costs and participation in annual training was \$430, and net after-tax earnings on gross

Reserve income represented only 7 percent of total annual after-tax income. Increasing Reserve pay by 50 percent would raise a guardsman or reservist's total income by only 3 to 4 percent and reenlistment rates by only 38 to 42 percent. Clearly, large increases in Reserve pay would be necessary to markedly affect retention rates.

Other factors also detract from the effectiveness of Reserve pay as an incentive. The Reserves represent only one form of moonlighting available to individuals and must compete with civilian moonlighting opportunities which usually provide more income. Civilian moonlighters, on the average, work 13 hours a week in their secondary job, while reservists average only 4. Since their hourly wages are approximately the same, the average civilian moonlighting job therefore provides three times more income than does service in the Reserves. If income were their primary goal, many reservists could probably find second civilian secondary jobs that would increase their annual income substantially more than participation in the Reserves.

Smaller income is only one feature that makes the Reserves less attractive than civilian moonlighting opportunities. Civilian jobs, for example, offer more flexibility in schedules and hours than do the Reserves and thus conflict less with the primary civilian job and family. In addition, civilian moonlighters usually do not have to sign contracts for terms of commitment nor attend periods of full-time training. Of course, they are also not subject to call-ups or mobilization.

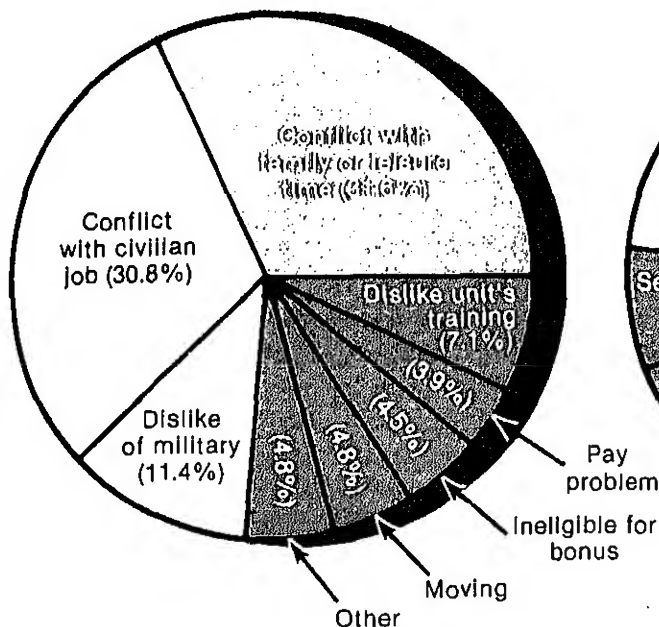
## *The role of the family and employer*

Participation in the Reserves does offer certain unique benefits to offset these various drawbacks. Retirement, insurance, education, and PX benefits, for example, can significantly increase the real value of Reserve income. Moreover, jobs in the Reserves sometimes provide better training than do jobs in the civilian sector. More intangible factors such as the fraternal, social, and service aspects of the Reserves can also be important. In fact, the minimal impact of pay on the reenlistment decision may well point to the greater importance of nonpay

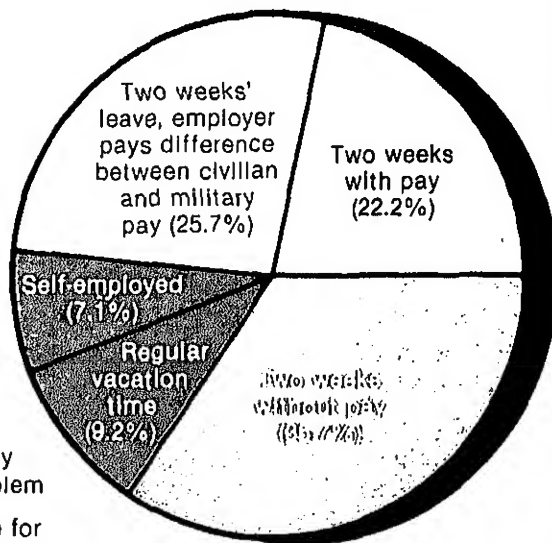
Conflicts with a reservist's family life or civilian job are much more important in separation decisions than a dislike of the military. Similarly,

a civilian employer's pay policy for reservists during annual training can deter future participation.

### REASONS FOR NOT REENLISTING



### EMPLOYER'S LEAVE POLICY



Other data collected during the survey confirms the importance of nonmonetary factors in the reenlistment decision. For example, asked why they left the Reserves, respondents often cited conflicts with their work and family life that increased the personal costs of participating (see Figure 5). External conflicts were much more important in separation decisions than dislike of the Reserves. Such conflicts are probably either not perceived at enlistment or come about due to changed circumstances in the lives of reservists between enlistment and reenlistment. The average reservist in our sample enlisted at age 20 and made the reenlistment decision at age 27; many would therefore have taken jobs, married, and had children since joining the Reserves. At age 20, personal preference is more likely to govern the decision to enlist. At age 27, more reservists have to consider the needs and

weigh possible conflicts with family and job.

Other characteristics of the reservist's civilian job also had a statistically significant effect on reenlistment. Higher wages, the number of hours worked, and greater opportunities for overtime, for example, all deterred Reserve participation. The civilian employer's attitude toward the Reserves, as perceived by the reservist, also strongly influenced the reenlistment decision. Unfavorable attitudes were most prevalent among small, private-sector employers, who are likely to have less flexibility that public-sector or large, private-sector employers in handling scheduling problems arising from drill or annual training. Their negative attitude deters participation.

Employers' policy on pay for reservists who participate in annual training also influences retention. Data from our survey indicate that employers follow one of four different annual training pol-

give no civilian pay and do not provide annual leave. The more restrictive civilian pay and military leave policies resulted in fewer reenlistments.

### Other factors

The age of the reservist at entrance had a marked effect on reenlistment behavior. Reservists who were older when they entered reenlisted at higher rates than those who were younger. The higher rates among older reservists may reflect the greater stability in job, family, and geographical location that tends to occur with age.

Other circumstances being equal, women, blacks, and nonhigh school graduates reenlist at higher rates than their counterparts. However, the differences, perhaps caused by poorer future economic opportunities in the civilian sector, are not large.

Among all factors analyzed, promotion to higher paygrades had the strongest impact on retention. Guardsmen and reservists who achieved higher paygrades reenlisted at significantly higher rates than those who did not. For nonprior-service personnel, achieving promotion means competing successfully with more senior, prior-service personnel, and because of the presence of prior-service personnel, opportunities to compete are often limited. Promotions not only open the possibilities of higher grades and pay in future years but also provide increased status within the unit. As others have noted, in their service and fraternal aspects, Reserve units are similar to voluntary organizations. Within such organizations, achieving positions of responsibility seems to be a strong motivation for staying.

### Conclusions

Research on the effect of Reserve pay on retention has several important implications for policymakers. Because the effect was much smaller than the Gates Commission had assumed, stabilizing Reserve strength at pre-all-volunteer force levels would have required additional pay beyond that recommended for the Reserve forces. Since 1978,

policy must therefore be sensitive not only to pay but also to Reserve benefits and to less quantifiable but perhaps equally influential factors such as organizational development and employer and family support.

One of the objectives of the study was to improve understanding of what motivates participation in the Reserves. Looked at from one perspective, Reserve service is a moonlighting job, and income is the primary motivator. From another perspective, the Reserves serve functions similar to those of leisure time and fraternal organizations; they satisfy the individual's needs for status and affiliation. We have found some support for both views. The decision to participate in the Reserves is not strictly a trade-off between additional income and leisure time. Rather, the Reserves seem to attract those who want both additional income and the job satisfaction available through the opportunities for service and association that the Reserves provide. **DMJ**

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*JOHN R. LILLEY II served as Director of Manpower in the Office of the Deputy Assistant Secretary of Defense for Reserve Affairs until July 1981. A retired Marine Corps colonel, Mr. Lilley was also project manager for DoD's Reserve Compensation Systems Study. He holds a bachelor's degree in mathematics from Clark University.*

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## Industry/joint services automatic test project final report

*Project chartered and sponsored by the Aerospace Industries Association, Electronic Industries Association, National Security Industrial Association, American Electronics Association, and Shipbuilders Council of America. The final report and executive summary can be obtained by contacting Project Executive Secretary Tom Burley, Jr., National Security Industrial Association, 1015 15th St., N.W. (Suite 5901), Washington, DC 20005.*

The increasing cost of operating and maintaining ultrasophisticated modern weapon systems directly affects the affordability of those systems. These costs have far-reaching implications not only for the DoD budget but for readiness and manpower as well. Given the complexity of the systems, manual maintenance is not possible; yet the alternative, automatic test, has emerged as the most significant driver of operations and support costs.

This report discusses the problems attendant upon automatic test as it applies to both the weapon system itself and supporting test systems at all maintenance echelons. The project team believes it has identified the primary causes of automatic test problems experienced by all the services and in this report outlines a program of technical and management recommendations to correct those problems.

The project team formulated its recommendations following a comprehensive benefits analysis study. The report stresses that the services need to carefully orchestrate the entire weapon system planning and acquisition cycle. Coordination is necessary to insure that tasks and trade-offs critical to automatic test are authorized and completed early in the weapon development phase. To effectively address operational problems will require attention to both on-line test functions actually built into the weapon system and off-line functions external to the basic system at various maintenance echelons. Implementation of the study group's recommendations, the report states, will have a major positive impact on such key factors as readiness, life-cycle cost, and manpower.

dressed two major problem areas: acquisition and management concerns and technical concerns. The study points to the basic but critical relationship between a weapon system and its integrated logistic support as the most significant project finding relating to acquisition and management. Integrated logistic support products—of which automatic test systems are important cost drivers—have traditionally received short shrift, the study notes, particularly during acquisition. They have therefore had a seriously negative, although delayed, impact during the operations or deployment phases. Similarly, in designing and developing weapon systems, supportability, in the form of effective testability, too often receives inadequate consideration. As a consequence, system readiness eventually suffers. This paper calls for a team concept that balances systems design and logistics engineering to help eliminate such problems.

Effective acquisition and management of automatic test systems also requires uniform, standard implementation of similar policies, procedures, and practices across the services, according to the study. Developments such as the proliferation of life-cycle cost models and implementation methods have led to a high degree of inconsistency in critical program decisions. Similar support scenarios elicit different decisions, to the detriment of effective weapon system support. Recognizing the importance of standardization to reducing acquisition and support costs, the project task groups devoted significant effort to evaluating its potential with respect to the many facets of automatic testing.

Testability, a subset of maintainability, is another area in which the study calls for more attention to compatibility among test systems and test-failure data at various maintenance and test echelons. The project team sees a critical need for high-level recognition of the influence of testability on final-system design and performance, especially given the degree of interdependence between end-item performance and system support in the field. Of paramount importance to adequate field maintenance, the report emphasizes, is serious and critical evaluation of the shop personnel automatic test system interface to insure that maintenance personnel receive the training they need. Definition and implementation of uniform, acceptable calibration methods throughout the services represent another serious problem affecting automatic testing, according to the study, largely because of a rapid, broad-based explosion in automatic test equipment metrology.

automatic test technical concerns, many of which are likewise the result of an explosive growth in technology in recent years. Dynamic changes in digital technology, most notably the development of the microprocessor, have significantly advanced weapon system design, and such innovation is likely to continue, possibly even at an accelerated rate. However, development of a test technology curriculum has lagged behind these advances, resulting in a shortage of qualified test personnel.

Support techniques for emerging technologies also require much more attention and study, according to the report. Measurement techniques and advanced maintenance planning and support concepts, for example, are not adequate, and failure to design the built-in-test function as an integral part of the weapon system has often lead to technical shortfalls. The report explains that unless design of automatic test systems addresses such factors as reliability and maintainability and the man-machine interface, the automatic test system itself can become a major impediment to weapon system readiness.

The study also urges that the joint services invest significant resources in efforts to apply automatic test generation to analog and hybrid technologies. Without such investment on a sustained basis, the project team concluded, the services will not be able to handle their electronic support requirements during 1985-1990. Finally, the report points to a need to more vigorously apply automatic test technology to nonelectronic equipment such as diesel, gas-turbine, and spark-ignition engines. Failure to make machinery systems compatible with automatic test techniques results in systems that are expensive, complex, and costly to operate and maintain.

## **When can cost-reducing R&D be justified—a simple explanatory model**

*The Rand Paper Series, The Rand Corporation, Santa Monica, CA 90406 (P-6372, September 1979)*

*By Bruno W. Augenstein*

An important class of expensive, often lengthy research and development projects seeks to produce

system. The goal of much energy technology R&D, for example, is to cut future costs of generating energy. Advocates of this kind of R&D often face critical choices between an early realization of modest technology and a significantly later realization of considerably more advanced technology.

This paper offers what the author calls "a very simple model" to assist in making such decisions. The model quantifies various parameters and interactions among parameters that affect R&D decisions. Quantification facilitates the choices among alternative R&D projects by making the possible trade-offs more easily discernible.

The author argues that it can often be economically much wiser, even when a large technological advance is achievable, to aim deliberately for a far lesser technological advance—if the lesser objective is obtainable earlier and at lower R&D cost. He regards his premise as "intuitively plausible," given the concept of "discounting" or the greater value of a dollar available this year versus one available next year. The concept, he notes, is sometimes ignored or dismissed by, or seemingly unfamiliar to, advocates of R&D projects.

The paper includes several examples which illustrate how the model can accommodate other factors that might have an impact on a proposed project, factors such as reductions in the capital cost of a new unit or a reduction in indirect costs. The examples also show the model's adaptability to changing circumstances which may require transition to a new configuration. Start-up time may be earlier or later than expected, for instance, or industrial capacity for building new units may limit production to only a few units per year. Whatever the circumstances or factors involved, the model seeks to provide a simple, transparent basis for discussing when cost-reducing R&D is economically justifiable. As presented in the paper, the model specifically addresses energy contexts; however, the author believes it is also applicable to more generalized situations such as defense-related R&D.

Because it allows for the discounting factor, the model often suggests that it is economically wiser to seek deliberately far less in the way of technological goals than the technologists say is possible. The author acknowledges that often the nature of the R&D institutional framework is to resist conclusions which do not favor the maximum accessible technology. Nonetheless, discounting calculations affords one clear means to help establish preferences among and assign priori-



## **Why actual costs of military construction projects vary from their estimates**

*U.S. General Accounting Office, Washington, DC (LCD-81-17, January 14, 1981). Request copies of GAO reports from: U.S. General Accounting Office, Document Handling and Information Services Facility, P.O. Box 6015, Gaithersburg, MD 20760.*

On many military construction projects the services must request funds beyond those originally appropriated, and some members of Congress have expressed concern over increasing requests for additional funds for such projects. However, in light of the magnitude of the military construction program, the lead time needed to prepare, process, and approve the budget, and the number of variables involved in cost estimating, the General Accounting Office has concluded that the services do a creditable job of estimating costs for hundreds of projects each year.

GAO found that many factors responsible for differences between estimated and actual construction costs are not related to the adequacy of DoD's cost-estimating procedures. Differences occur for several reasons: degree of bidder interest in a project, fluctuations in material and labor costs, changes in the bid opening date, changes in requirements or design or both after budget submission, and changes in site location for geographical and environmental reasons.

More than any other single factor, according to the study, degree of bidder interest affects construction costs. When several contractors are interested in a project, the competition often results in lower bids. When only two or three contractors bid, the cost is likely to be higher. Factors such as type and location of the project and the amount of other construction work available all affect bidder interest. In preparing bids, GAO notes, contractors can severely alter amounts included for profit and overhead if they want a particular contract badly enough. However, such desire is difficult to predict two years in advance, when the services are preparing their cost estimates for military construction projects.

The inflation figures DoD is required to use in preparing budget estimates further contribute to discrepancies

Management and Budget has predicted inflation rates much lower than have actually been the case. Of approximately \$380 million DoD requested in February 1980 for complete projects previously funded, the Department estimated that \$98 million was due to use of low inflation rates supplied by OMB. For fiscal years 1980 and 1981, OMB provided inflation rates of 7.0 and 8.9 percent, respectively, for use in budget estimates; DoD projected rates of 12.0 and 10.8 percent for the same two years.

Because many of the factors that contribute to differences between budgeted and actual costs do not relate to the adequacy of cost-estimating procedures, GAO does not believe that a more stringent legislative policy, on reprogramming of funds would result in substantially better or more accurate military construction cost estimates. It does endorse attaining a minimum 35-percent design to support cost estimates included in budget submissions; estimates based on at least 35-percent design, GAO found, correlate more closely to actual working estimates.

## **Training effectiveness of platform motion: review of motion research involving the advanced simulator for pilot training and the simulator for air-to-air combat**

*Air Force Human Resources Laboratory, Air Force Systems Command, Brooks Air Force Base, TX 78235 (AFHRL-TR-79-51, February 1981)*

*By Elizabeth L. Martin, Operations Training Division, Williams Air Force Base, AZ 85224*

Will the addition of platform motion to a flight simulator increase the effectiveness of simulator training? Transfer-of-training experiments try to answer this question by determining how and to what extent practice on one task influences performance on another.

This study summarizes and integrates the findings of six such experiments that compare the presence versus absence of platform motion training on performance in an aircraft. The experiments involved various devices to

degrees-of-freedom platforms, G-suits, G-seats, and limited special effects such as cockpit and stick shakers.

This report does not purport to contain the answer regarding platform motion simulation. However, it does conclude that the addition of task-correlated platform motion cueing to simulators has negligible transfer-of-training value for novice jet pilots.

Five of the experiments, conducted at Williams AFB, Arizona, used the advanced simulator for pilot testing; the other, carried out at Luke AFB, Arizona, used the simulator for air-to-air combat. The participants were student pilots at varying levels of ability, including both pre- and post-solo students and replacement training unit students. Tasks addressed included basic contact, aerobatics, basic fighter maneuvers, and conventional bombing tasks.

The expectation before undertaking the experiments was that use of modern platform motion systems would significantly enhance transfer of flying skills to the aircraft. The main question was thought to be the magnitude of the effect, that is, whether it would be sufficient to justify the cost or whether a less costly system might be more cost effective. The commonly held belief among pilots, the study points out, was (and perhaps is) that some form of motion cueing is necessary in order to enhance realism and thereby increase pilot acceptance of simulator training. However, the experiments did not confirm these expectations.

The report lists three conclusions that follow from the studies reviewed:

- Platform motion has little or no demonstrated positive effect on transfer of training.
- Platform motion has a small effect on performance of experienced pilots in the simulator.
- Platform motion has most potential for enhancing simulator training on specific tasks requiring control in a marginally stable condition.

These conclusions, according to the author, are consistent with existing data on transfer of instrument skills.

The findings are especially significant because the express purpose for procuring modern six-post synergistic platforms has been to enhance transfer of training to aircraft. As the study notes, since evidence to date does not demonstrate increased transfer, the services can achieve substantial cost savings by not procuring these platform-motion systems and by not using the motion system on existing simulators that already have synergistic platform-motion systems. A much simpler

freedom synergistic system would suffice to simulate the type of motion cues that result from disturbance-induced conditions.

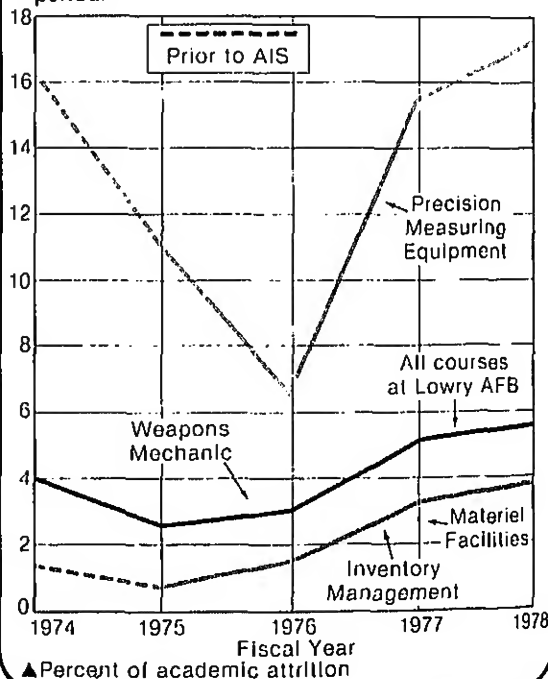
## Correction

The Second Quarter 1981 *DMJ* was identified on page 1 of that issue as Volume 18, Number 2. It should have been Volume 17, Number 2.

Due to an error in print production, one of the bars in Figure 5 of *Computer-based instruction for military training* by Jesse Orlansky and Joseph String (Second Quarter 1981, page 52) was not reproduced. The corrected figure appears below.

**Figure 5. The effect of computer-based instruction on academic attrition.**

Academic attrition may have increased in the four courses on the Advanced Instructional System while they were being implemented in a computer-based mode, but attrition appeared to rise in all courses at Lowry AFB over the same period.



degrees-of-freedom platforms, G-suits, G-seats, and limited special effects such as cockpit and stick shakers.

This report does not purport to contain *the* answer regarding platform motion simulation. However, it does conclude that the addition of task-correlated platform motion cueing to simulators has negligible transfer-of-training value for novice jet pilots.

Five of the experiments, conducted at Williams AFB, Arizona, used the advanced simulator for pilot testing; the other, carried out at Luke AFB, Arizona, used the simulator for air-to-air combat. The participants were student pilots at varying levels of ability, including both pre- and post-solo students and replacement training unit students. Tasks addressed included basic contact, aerobatics, basic fighter maneuvers, and conventional bombing tasks.

The expectation before undertaking the experiments was that use of modern platform motion systems would significantly enhance transfer of flying skills to the aircraft. The main question was thought to be the magnitude of the effect, that is, whether it would be sufficient to justify the cost or whether a less costly system might be more cost effective. The commonly held belief among pilots, the study points out, was (and perhaps is) that some form of motion cueing is necessary in order to enhance realism and thereby increase pilot acceptance of simulator training. However, the experiments did not confirm these expectations.

The report lists three conclusions that follow from the studies reviewed:

- Platform motion has little or no demonstrated positive effect on transfer of training.
- Platform motion has a small effect on performance of experienced pilots in the simulator.
- Platform motion has most potential for enhancing simulator training on specific tasks requiring control in a marginally stable condition.

These conclusions, according to the author, are consistent with existing data on transfer of instrument skills.

The findings are especially significant because the express purpose for procuring modern six-post synergistic platforms has been to enhance transfer of training to aircraft. As the study notes, since evidence to date does not demonstrate increased transfer, the services can achieve substantial cost savings by not procuring these platform-motion systems and by not using the motion system on existing simulators that already have synergistic platform-motion systems. A much simpler

freedom synergistic system would suffice to simulate the type of motion cues that result from disturbance-induced conditions.

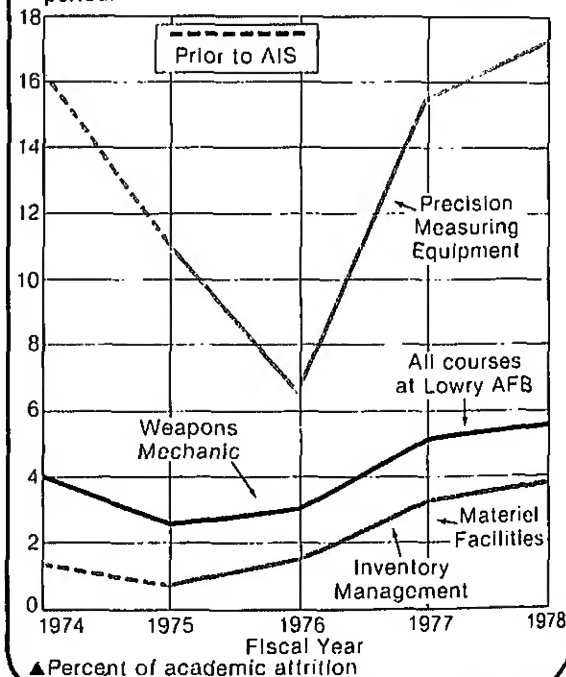
## Correction

The Second Quarter 1981 *DMJ* was identified on page 1 of that issue as Volume 18, Number 2. It should have been Volume 17, Number 2.

Due to an error in print production, one of the bars in Figure 5 of *Computer-based instruction for military training* by Jesse Orlansky and Joseph String (Second Quarter 1981, page 52) was not reproduced. The corrected figure appears below.

**Figure 5. The effect of computer-based instruction on academic attrition.**

Academic attrition may have increased in the four courses on the Advanced Instructional System while they were being implemented in a computer-based mode, but attrition appeared to rise in *all* courses at Lowry AFB over the same period.



## **Standardization initiatives seminar**

"Current initiatives in the Defense Standardization and Specification Program to improve the Acquisition Process" is the theme of a Department of Defense seminar to be held November 3-5, 1981, in Leesburg, Virginia. The seminar will focus on standardization issues that affect DoD acquisition initiatives called for in Deputy Secretary of Defense Frank C. Carlucci's memorandum of April 30, 1981. Attendance is limited to Defense employees.

During an overview briefing scheduled for the first half-day session, high-level executives from the Office of the Secretary of Defense will explain standardization and specification program concepts and how they apply to the acquisition process. Various workshops to be held each day will attempt to develop approaches to short-term and long-term standardization problems which impede the reduction of time and cost required for materiel acquisition and which hinder improvements to weapon systems support and mission readiness.

In addition, discussion panels will meet to examine in detail capabilities and current initiatives in the standardization program and how they can be

applied to support Deputy Secretary Carlucci's acquisition recommendations. These panels will consider how various standardization program elements relate to such acquisition goals as product improvement, multi-year procurement, increased capital investment and productivity, greater reliability, more accurate budget estimates, and a stable business base in defense plants.

The only expense to attendees' organizations will be for transportation to and from Leesburg. Registration, lodging, and meals will be provided.

## **Realignment of DoD policy offices**

The offices of the Under Secretary of Defense for Policy have been reorganized, with the creation of an Assistant Secretary of Defense for International Security Policy. The new office, to be headed by Richard Porle, will assume responsibility for political-military activity involving NATO, other European countries, and the U.S.S.R., especially those activities concerning nuclear policy, arms control, East-West trade, and technology transfer.

The existing office of the Assistant Secretary of Defense for International Security Affairs will continue to have responsibility for other areas of the

world and for the Defense Security Assistance Agency. Francis B. West is slated to become the next ASD(ISA); his functional areas will include conventional forces, counter-insurgency, counter-terrorism, and non-nuclear contingency planning.

## **Rehabilitating troubled employees**

DoD has awarded a two-year, \$260,000 contract to Comprehensive Care Corporation (CompCare) to provide an employee assistance program to more than 14,000 civilian employees working in the Pentagon.

The purpose of the program, which will be known as the Pentagon Employee Referral Service, is to help employees with personal problems that are affecting their job performance. It will emphasize education and training for supervisors and marketing techniques for reaching troubled employees.

CompCare has developed similar Employee Assistance Programs for business and industry nationwide. The rationale for such programs is that it is more humane and cost effective to rehabilitate employees and return them to productivity than to fire them.

Robert Stein, assistant director for education and rehabilitation and coordinator of civilian programs

in the Office of the Assistant Secretary of Defense (Health Affairs), will serve as the government's contracting officers' technical representative. He will work with Jack Suddath, CompCare's program coordinator.

Stein said that the employee assistance program is not a totally new effort but will be the first time such a campaign has been consolidated to include all civilian defense components of the federal government.

Additional information about CompCare's employee assistance program can be obtained by contacting national consultant David Shay at (314) 291-1144.

## **Navy establishes oversight council**

Secretary of the Navy John Lehman has established a Council on Review and Oversight to identify areas in need of top management attention to reduce fraud, waste, and abuse. Chairman of the council is Under Secretary of the Navy Robert J. Murray, assisted by Vice Chief of Naval Operations Admiral James T. Watkins and Assistant Commandant of the Marine Corps General Kenneth McLennan.

The council has instituted new follow-up proce-

dures for audits of Navy and Marine Corps activities and is also focusing on opportunities for enhanced efficiencies. Two programs already identified for potential savings are accelerated aircraft procurements and a revised acquisition strategy that includes multi-year procurement schedules.

### **Changes announced in manning system**

Under a concept approved by Army Chief of Staff General E. C. Meyer, revolutionary changes are being planned in developing the Army's manning system. Unlike the existing assignment system, under which soldiers rotate overseas on an individual basis, the new manning concept will focus on unit rotation. According to General Meyer, the Army is "moving to a system in which unit replacement will be the norm."

These new units are called COHORT companies. The acronym is derived from the words cohesion, operational readiness, and training. Soldiers in newly formed COHORT units at Fort Knox, Kentucky; Fort Sill, Oklahoma; and Fort Benning, Georgia, will take basic, advanced, and unit training together. The first units will rotate in Oc-

The new manning system is a direct outgrowth of the Army's study of cohesion and stability that General Meyer announced last September. The purpose of that review was to find ways to foster a more stable environment, reduce personnel turbulence, and improve combat readiness and cohesion within the Army's fighting units at battalion, company, platoon, and squad levels.

The complex changes envisioned under the COHORT concept are now in the formative stages of development. A special task force, headed by Major General Charles W. Bagnal, is developing the new system. Final plans are expected to be completed next fall.

### **Ruling on employer's obligation**

In a five-to-four decision, the Supreme Court ruled that reservists' employers have no obligation to change work schedules to accommodate Army Reserve training. Under this ruling, employers are not required to allow reservists to make up wages lost due to military training. On the other hand, the Court did affirm the safeguard that reservists cannot be denied promotions, be discharged, or be discriminated against because of Reserve com-

*Monroe versus Standard of Ohio* was filed by Roger Monroe for wages lost while he attended weekend training. The suit was based on provisions of the Vietnam-era Veterans Readjustment Act of 1974 which, in part, provides that employers cannot discriminate against reservists because of absences incident to their military obligation.

### **New director for defense institute**

Colonel Shirley J. Bach, USAF, has been appointed Director of the Defense Equal Opportunity Management Institute at Patrick Air Force Base, Florida. Colonel Bach had been Deputy Director for Academics at the Institute since June 1978 and previously served as a special assistant to the Assistant Secretary of the Air Force (Manpower, Reserve Affairs and Installations).

The Defense Equal Opportunity Management Institute, formerly the Defense Race Relations Institute, trains DoD military and civilian personnel who have responsibilities as equal opportunity specialists, staff officers, and instructors in human and race relations. The Institute also provides consultant services and assistance on human resources and equal opportunity matters to DoD

Since its creation in June 1971, the Institute has trained more than 6,000 persons for the armed forces.

### **Program realizes \$401,000 savings**

An Air Force program to reduce the cost of buying new equipment has resulted in \$401,000 in savings, which will be shared by Westinghouse Electric Corporation and the Air Force Electronic Systems Division's Airborne Warning and Control System.

The Air Force-wide cost-cutting procedure, known as the Value Engineering Program, encourages contractors to submit suggestions which will reduce initial equipment costs as well as long-range maintenance and spare-parts expenses.

On its contract to provide radar test equipment for Air Force repair depots, Westinghouse suggested modifications which eliminated the need for one of nine major system components. Under the Value Engineering Program, the Air Force passed favorably on the suggestion in terms of equipment eliminated, reduced test time, and long-range savings. As a result of the \$401,000 savings under the program, the Air Force reduced the contract price by \$196,994 and awarded Westinghouse

<b>Event</b>	<b>Date</b>	<b>Place</b>	<b>Contact</b>
Very High Speed Integrated Circuits	Sep 3-4	Boston, MA	AIAA Conferences Department VHSIC P.O. Box 91295 Los Angeles, CA 90009 (213) 670-2973
A Basic Orientation In Equal Employment and Affirmative Action	Sep 14-16 Oct 5-7 Oct 19-21	Washington, DC Houston, TX New York, NY	American Management Associations 135 West 50th Street New York, NY 10020 (212) 246-0800
An In-depth Program in Equal Employment and Affirmative Action	Sep 17-18 Oct 8-9 Oct 22-23	Washington, DC Houston, TX New York, NY	
Program Planning and Evaluation	Sep 21-23	Washington, DC	
Increasing Productivity through Stress Management	Sep 28-29 Nov 9-10	Washington, DC	Graduate School, USDA Special Programs 277 National Press Building 529 14th Street, NW Washington, DC 20045 (202) 447-3247
Cost-Schedule Control Systems Workshop	Oct 5-7	San Francisco, CA	NIMR Seminars Dept Y-Cost Seminars P.O. Box 3727 Santa Monica, CA 90403 (213) 450-0550
ADA Seminar	Oct 14-16 Oct 19-21	Boston, MA Bethesda, MD	ADA Education Edwina Ledgard Leverett, MA 01054 (413) 549-6123
Warehousing-Distribution Operations Using Computer Systems	Oct 19-21	Washington, DC	Continuing Engineering Education Program George Washington University Washington, DC 20052 (202) 676-6106
Government-Industry Data Exchange Program	Oct 20-22	Palo Alto, CA	Officer-In-Charge GIDEP Operations Center Corona, CA 91720 (408) 742-7406
Trends in International Logistics	Oct 21-22	Arlington, VA	NSIA (Dept. IL) Suite 901 1015 15th Street, NW Washington, DC 20005 (202) 393-3620
Current Standardization Program Initiatives for Improving the Acquisition Process	Nov 3-5	Leesburg, VA	Defense Materiel Specifications and Standards Office Two Skyline Place Suite 1403 5203 Leesburg Pike Falls Church, VA 22041 (703) 756-2343